WEST BRANCH
GRAND CALUMET RIVER BASIN
EAST CHICAGO, INDIANA

FINAL

FIELD SAMPLING AND ANALYSIS PLAN

October 2002
Revision 1

Prepared by

FOSTER WHEELER

FOSTER WHEELER ENVIRONMENTAL CORPORATION

12100 NE 195th Street
Bothell, Washington
(425) 482-7600
(425) 482-7652 (Fax)

Prepared for

U.S. Fish and Wildlife Service
Bloomington Field Office
620 South Walker Street
Bloomington, Indiana 47403

Under Contract to

United States Fish and Wildlife Service
Environmental and Facility Compliance Branch
P.O. Box 25207
7333 W. Jefferson Avenue, Suite 375
Denver, Colorado 80225-0207

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ACRONYMS AND ABBREVIATIONS

µg/kg	micrograms per kilogram
ASTM	American Society for Testing and Materials
CAS	Columbia Analytical Services
CDF	Confined Disposal Facility
DDD	dichloro-diphenyl-dichloro-ethane
DDE	dichloro-diphenyl-dichloro-ethylene
DDT	dichloro-diphenyl-trichloro-ethane
DGPS	differential global positioning system
DI	
DRET	dredging elutriate test
EBGCR	East Branch of the Grand Calumet River
EM	Engineer Manual
EPA	U.S. Environmental Protection Agency
FCR	Field Change Request
FOL	Field Operations Leader
Foster Wheeler Environmental	Foster Wheeler Environmental Corporation
FSAP	Field Sampling and Analysis Plan
GCR	Grand Calumet River
GCRRF	Grand Calumet River Restoration Fund
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
LPAH	low molecular weight polycyclic aromatic hydrocarbons
MET	modified elutriate test
mg/kg	milligrams per kilogram
mL	milliliter
MS	matrix spike
MSD	matrix spike duplicate
NAD	North American Datum
NAPL	nonaqueous phase liquid
NGVD	National Geodetic Vertical Datum
OD	outer diameter
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl

ACRONYMS AND ABBREVIATIONS (CONTINUED)

PEC	probable effect concentrations
PM	Project Manager
PPE	personal protective equipment
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RAP	Remedial Action Plan
RCRA	Resource Conservation and Recovery Act
RSD	relative standard deviation
SOP	Standard Operating Procedure
SOW	Scope of Work
STI	Soil Technologies, Inc.
STL	Severn Trent Laboratories
SVOC	semivolatile organic compound
TDL	target detection limit
TOC	total organic carbon
TSS	total suspended solids
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UU	unconsolidated undrained
VOC	volatile organic compound
WBGCR	west branch of the Grand Calumet River

1. INTRODUCTION

This Field Sampling and Analysis Plan (FSAP) has been prepared by Foster Wheeler Environmental Corporation (Foster Wheeler Environmental) in accordance with the requirements of the Scope of Work (SOW) for Task Order 02-Y037 of Contract 1448-98695-98-C008, dated August 5, 2002. The plan was prepared for the U.S. Fish and Wildlife Service (USFWS) Environmental and Facility Compliance Office at the request and direction of the USFWS – Bloomington Field Office as a project planning document for the implementation of the chemical, physical, and toxicological characterization of the West Branch of the Grand Calumet River, Indiana (WBGCR). The USFWS is acting as the contracting agency on behalf of the Grand Calumet River Restoration Fund (GCRRF) Council, which is composed of USFWS, Indiana Department of Environmental Management (IDEM), U.S. Environmental Protection Agency (EPA), and Indiana Department of Natural Resources (IDNR).

This FSAP summarizes the Phase 2 field and laboratory tasks necessary to complete a sediment characterization and bathymetry investigation for the WBGCR. The objective of this effort is to conduct a bathymetry survey of the river and a topographic survey of the riverbanks and adjacent uplands, and to further characterize surficial and deeper historical sediments within portions of the river. Upon completion, the Phase 2 tasks will be used by Foster Wheeler Environmental to prepare a Restoration Alternatives Development and Evaluation Report on the WBGCR.

This FSAP describes the tasks associated with sample collection, handling, shipment, and analysis.

1.1 PROJECT HISTORY AND SUMMARY

The Great Lakes Water Quality Agreement of 1978 identified the Grand Calumet River (GCR) and Indiana Harbor Canal as one of 43 areas of concern having one or more specific impairments to beneficial uses of Great Lakes waters. The Agreement directed that a Remedial Action Plan (RAP) be developed and implemented at each area of concern in order to restore the beneficial uses. IDEM submitted a Stage 1 RAP to the International Joint Commission in 1991 and a Stage 2 RAP in 1997.

Following settlement with Industrial Users of the Hammond Sanitary District in February 1997, a Trust Agreement for GCRRF was established and by Memorandum of

Understanding among EPA, USFWS, IDNR and IDEM. At this time, the GCRRF Council was established. Payments to the GCRRF by settling parties was to address the effects of sediment contamination in the WBGCR, specifically for the purpose of addressing and correcting environmental contamination in the area of concern, including particularly the cleanup of contaminated sediment in the GCR and the remediation and restoration of natural resource damages within the area of concern.

1.1.1 Site History

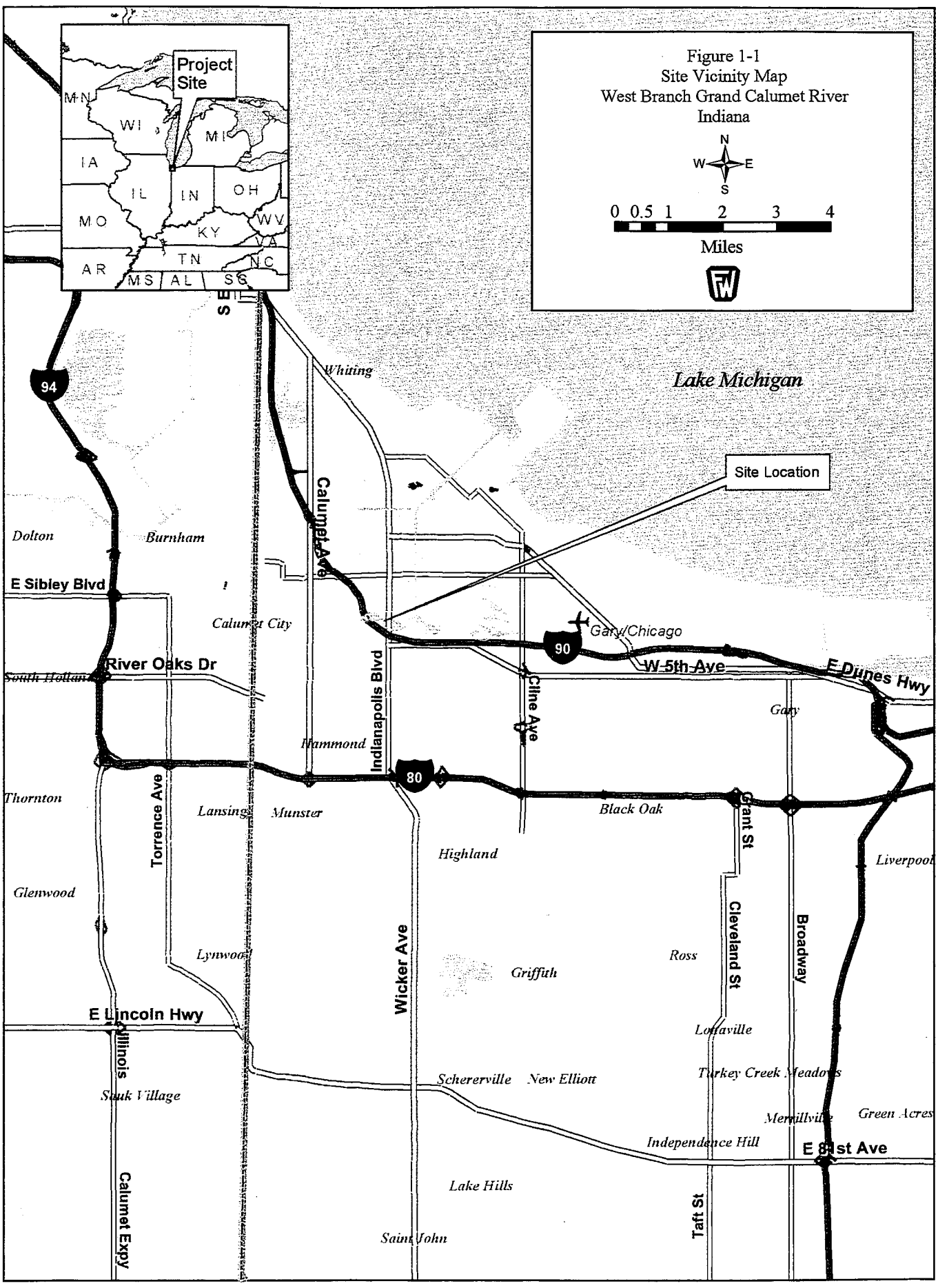
The GCR comprises two east-west oriented branches that meet at the southern end of the Indiana Harbor Ship Canal. Figure 1-1 presents the site vicinity. The east branch of the Grand Calumet River (EBGCR) originates at the Grand Calumet Lagoons, just east of the United States Steel Gary Works facility. The EBGCR flows west from this point for approximately 10 miles to its confluence with the Canal. The WBGCR usually flows both east and west, with a hydraulic divide typically present in the vicinity of the Hammond Sanitary District outfall just east of Columbia Drive. Historically, the volume and direction of water flow through the river was determined by Lake Michigan water levels. During periods of high lake levels, flow may be to the west throughout the WBGCR. Drops in the level of Lake Michigan since 1997 has resulted in reduced water level in the river.

The natural watershed of the GCR lies within the Calumet lacustrine plain, which extends from the modern Lake Michigan shore to the Valparaiso terminal moraine. The Lake Michigan lobe of the Laurentian ice sheet began to retreat, after the Wisconsin glaciation, and the Valparaiso terminal moraine marks its furthest southern advance before receding.

Prior to about 1850, the GCR flowed east from a point near the GCR to the area now encompassed by Marquette Park in Miller, Indiana, where the river emptied into Lake Michigan. As the western end of the river was developed for navigation at the confluence with the Little Calumet River, the mouth of the GCR at Marquette Park became permanently closed by sand dunes. Construction of the Indiana Harbor Canal began in 1903.

1.1.2 Environmental Setting

Approximately 2-1/2 miles of the WBGCR, located between Indianapolis Boulevard and the Indiana/Illinois State line, will be evaluated in this study. Based on a preliminary analysis of



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February 28, 2002

potential remedial technologies, the physical site conditions, and waterway setting, Foster Wheeler Environmental has proposed a division of the WBGCR into the following project reaches:

1) from the Indianapolis Boulevard Bridge to the Interstate 90 Bridge,
2) from the Interstate 90 Bridge to the Columbia Avenue Bridge,
3) from the Columbia Avenue Bridge to the Calumet Avenue Bridge,
4) from the Calumet Avenue Bridge to the Sohl Road Bridge,
5) from the Sohl Road Bridge to the Hohman Avenue Bridge,
6) from the Hohman Avenue Bridge to the railroad bridge, and
7) from the railroad bridge to the Indiana/Illinois state line.

Phase 2 work will be referenced within these proposed divisions of the WBGCR.

1.2 PURPOSE OF STUDY

The review of existing information in the literature and databases led to the identification of several data gaps that will need to be filled before the alternatives evaluation process (Foster Wheeler Environmental 2002a). At this time, the data gaps include the following six types of data and information:

1) Bathymetric/topographic survey data
2) Preparation of engineering base drawings
3) Transferal of historical sediment core data to base drawings
4) Collection of additional core samples for chemical and physical property tests
5) Gathering information on access to the river for implementation of the Restoration Plan
6) Need for local sources of services and material

The bathymetry/topography survey information will be used to:

- establish riverbed topography and core sample elevations in relation to the waterway and the project vertical datum,

- develop remedial alternatives and estimated dredging/capping quantities for the various reaches of the project (due to the shallowness of the river, capping is considered infeasible as a stand-alone alternative),
- assess potential disposal sites along the river,
- evaluate potential access to the site, and
- later, if needed, aid in the preparation of final restoration plans based on the selected alternative(s).

Using the contour maps resulting from the bathymetric/topographic survey, Foster Wheeler Environmental will prepare engineering base drawings. These drawings will serve several purposes:

- Historical sampling locations and riverbed topography will be located on the drawings.
- Sampling locations will be documented on the drawings.
- After completion of additional sampling, contaminated sediment sections will be drawn.
- The drawings will be used to lay out preliminary dredge prisms and capping areas and compute dredged material and/or capping material quantities (due to the shallowness of the river, capping is considered infeasible as a stand-alone alternative).
- The drawings will also be used to preliminarily locate and lay out potential upland access and dredged material disposal areas adjacent to the waterway.

Based on a review of the sediment sampling data contained in the MacDonald Grand Calumet database and discussions with Don MacDonald, USFWS, and IDEM, it appears that there are insufficient data for the evaluation of nature and extent of contamination within many of the river reaches along the West Branch. There are substantially fewer data points proportionally in the West Branch than in the other reaches of the Grand Calumet River that were similarly evaluated in 2000 (Foster Wheeler 2000). Consequently, additional data are required to develop the restoration alternatives for the WBGCR. Restoration plans will require additional information on both sediment chemistry and physical characteristics (i.e., total metals, semivolatile organics, chlorinated pesticides, polychlorinated biphenyls, total

organic carbon, and grain size distribution). Additional borings and sediment chemistry data are required in the River Reaches 1-5, and 7.

There are also insufficient geotechnical data to evaluate the engineering properties of the sediment that will be needed for remedial alternatives analysis and design. The sediment characteristics will help in determining the range of dredging equipment and the capacity of the sediments to support equipment. Determining the sediment characteristics will require additional core borings and geotechnical testing for Atterberg limits, percent solids, and specific gravity. Additional engineering property tests, such as laboratory unconsolidated undrained shear strength, laboratory consolidation, and column settling are also required.

1.3 FIELD SAMPLING AND ANALYSIS PLAN ORGANIZATION

This sampling and analysis plan presents the methods used to conduct the field investigation. Section 2 discusses existing information, Section 3 discusses field methods for sample collection, and Section 4 outlines the laboratory analysis methods. Section 5 outlines waste management and Section 6 discusses project documentation.

2. EXISTING INFORMATION AND LIMITATIONS

From the limits of the Indianapolis Boulevard Bridge to the State Line Avenue Bridge along the Grand Calumet River, approximately 150 stations have been sampled during 11 previously performed studies (ThermoRetec 1999, 1997; IDEM 1999, 1998, 1994; URS 1998; Burton 1994; Dorkin 1994, 1993; Hoke et al. 1993; Polls et al. 1993; Unger 1992; HNTB 1991, 1989). Samples were taken at various depths and locations along the river within the seven distinct reaches. Historical and proposed sampling stations located within each reach are presented on Figures 2-1 through 2-12. The highest number of stations sampled previously are located in Reach 2, followed by Reach 6 and Reach 1. Reach 3 contains the least number of historical sampling stations, while the number of stations in Reaches 4, 5, and 7 are roughly equivalent. The chemistry data gathered from each station are presented in Appendix D and summarized in Table 2-1 (MacDonald and Ingersoll, 2000). Non-detected analytes were factored into the statistical data and valued at the reported detection limits.

While approximately 30 metals were analyzed and detected in sediments from previous studies, heavy metals detected in sediments that can be particularly toxic at high doses were arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc. The average concentration for each of these heavy metals was found to be approximately 27, 11, 140, 190, 730, 1.2, 57, and 1,600 milligrams per kilogram (mg/kg), respectively. Of the heavy metals, lead and zinc had the highest maximum concentrations of 12,000 mg/kg and 11,000 mg/kg, respectively, both of which occurred in Reach 2. A majority of the heavy metal maximums occurred in Reaches 1 and 2.

The only VOC widely sampled for and detected at 32 out of 59 stations was benzene. The average concentration of benzene was 9,600 micrograms per kilogram (µg/kg), and the concentration range of benzene was from 5.5 µg/kg (which corresponds to the lowest detection limit) to 50,000 µg/kg. The maximum benzene concentration occurred in three sampling stations located within Reaches 5 and 6.

Of the numerous SVOCs analyzed in sediments of the WBGCR, only 21 compounds were detected and identified. Of the parameters that were detected and identified, those with average concentrations greater than 100,000 µg/kg included carbazole and low molecular weight polycyclic aromatic hydrocarbons (LPAHs), 2-methylnapthalene, acenaphthene, naphthalene, and phenanthrene. The average concentrations for the detected SVOCs ranged

from approximately 20,000 µg/kg (phenol) to 246,000 µg/kg (napthalene). Napthalene also had the highest maximum concentration detected of 3,800,000 µg/kg, which occurred in Reach 6. The second highest SVOC maximum concentration detected was 3,400,000 µg/kg, which occurred for 2-methylnapthalene in Reach 6. Of the maximum concentrations detected, 16 maximums occurred in Reach 6, five occurred in Reach 1, and two occurred in Reach 2. The concentrations of total polycyclic aromatic hydrocarbons (PAHs) detected ranged from 20 µg/kg to 14,200,000 µg/kg, which consists of sample results that both include and exclude the detection limits if they are less than the probable effect concentrations (PECs). The highest concentrations of PAHs were observed in Reach 6.

Historical data was available for seven specific polychlorinated biphenyls (PCBs), however only Aroclors 1242, 1248, 1254, and 1260 were detected among the parameters analyzed. The average concentrations for the detected PCBs ranged from approximately 3,600 µg/kg (Aroclor 1254) to 5,400 µg/kg (Aroclor 1248). The average concentration of total PCBs, sampled at 62 stations along the river and detected at 27 of the stations, was 19,910 µg/kg. The maximum concentration of total PCBs was found to be 560,000 µg/kg. The maximum concentrations detected for each analyte as well as for total PCBs were all located in Reach 7 at Station SD-13. Total PCBs was also calculated via summing the various Aroclors; for these five data sets, the average total PCBs concentration was 4,100 µg/kg and the maximum was 7,900 µg/kg, which occurred in Reach 1.

Of the pesticides analyzed in the various studies performed on the river sediments, approximately 13 pesticides were detected. The average concentrations of detected pesticides ranged from 55 µg/kg (the beta isomer of hexachlorocyclohexane) to over 6,000 µg/kg (toxaphene). Toxaphene also had the maximum pesticide concentration of 67,000 µg/kg, which was found in Reach 1. A majority of the remainder of maximum concentrations was detected in Reach 2. For dichloro-diphenyl-trichloro-ethanes (DDTs), the concentrations of p,p´-dichloro-diphenyl-dichloro-ethane (DDD) and o,p´-DDD, p,p´-dichloro-diphenyl-dichloro-ethylene (DDE) and o,p´-DDE, and p,p´-DDT and o,p´-DDT were summed to calculate the concentrations of sum DDD, sum DDE, and sum DDT, respectively. Depending on whether the DDTs were determined during each study or calculated for the data summary, the maximum concentrations were found in either Reach 1 or Reach 2. The total DDT concentrations were calculated by summing the concentrations of sum DDD, sum DDE, and, sum DDT. All three methods of calculating total DDT resulted in a maximum concentration located in Reach 2. The average total DDT concentrations ranged from 3,100 µg/kg to 5,300 µg/kg, and the highest maximum total DDT concentration was close to 20,000 µg/kg.

Only one dioxin, 2,3,7,8-dibenzo-p-dioxin, was analyzed for at 10 sampling stations. The average concentration of this parameter was 0.0027 µg/kg and the maximum was 0.0061 µg/kg. The maximum concentration was detected at one station located in Reach 2.

As can be seen in the list of conventional parameters in Table 2-1, ammonia-nitrogen was the only parameter analyzed in most samples, which were taken from within Reaches 1, 2, 4, and 6. The average concentration for ammonia-nitrogen was 762 mg/kg and the maximum was 2,140 mg/kg, which occurred in Reach 2. From the limited particle size information, the upper sediment layers of Reach 6 appear to be comprised of sand, silt, and clay, while the upper sediments of Reaches 2 and 7 at the few sampled locations were predominantly sand and gravel.

Also included in Figures 2-1 through 2-3 are the 20 locations collected by Foster Wheeler Environmental in Roxana Marsh in March 2002. Details of sample results are found in the *Field and Laboratory Data Report for the Chemical, Physical, and Toxicological Characterization of Roxana Marsh* (Foster Wheeler Environmental 2002b).

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NOTES:

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2. EXISTING TOPOGRAPHIC DATA IS BASED ON MERRICK & CO. SURVEY (1996).
3. EXISTING SURVEY IS BASED ON INDIANA STATE PLANE NAD83.
4. HISTORICAL SAMPLING STATION LOCATIONS ARE APPROXIMATE.
5. PROPOSED SAMPLING LOCATIONS ARE BASED ON INDIANA STATE PLANE, WEST ZONE, NAD 83.

LEGEND:

● HISTORICAL SAMPLING STATION

□ PROPOSED SAMPLING STATION

STATION	NORTHING	EASTING
WB-1	2319767.98	2843581.40
WB-2	2319756.35	2843545.15
WB-3	2319744.72	2843508.89

N

25 0 25 50 75
(Scale in Feet)
HORIZONTAL SCALE

WEST BRANCH OF THE GRAND CALUMET RIVER
FIGURE 2-1
SAMPLE STATION LOCATIONS
(REACH 1)

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DESIGNED: –	APPROVED	
DRAWN: AEC		DATE: 9/20/02
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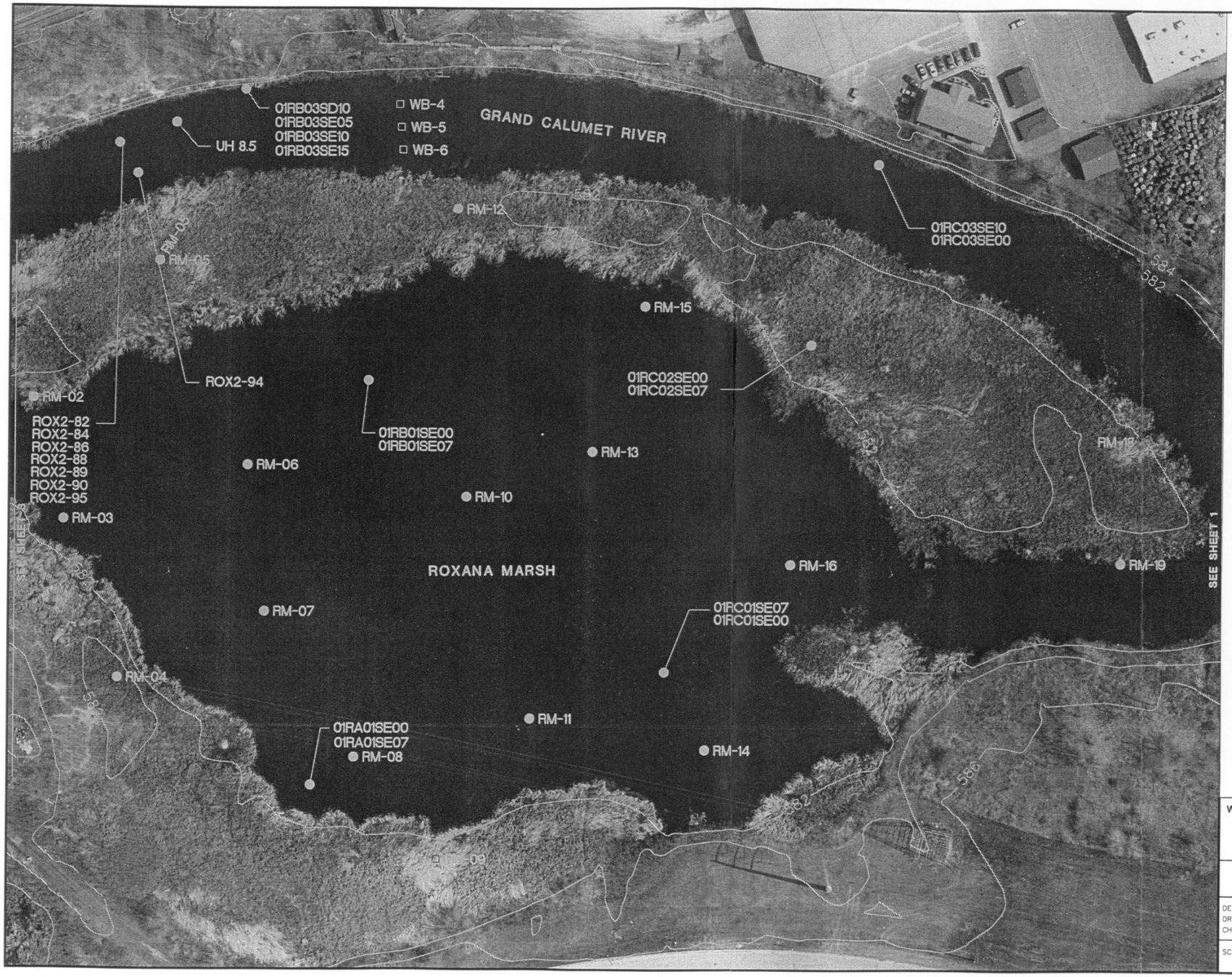
SCALE: AS NOTED	DRAWING NO. MGCABM01	1/12



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4. HISTORICAL SAMPLING STATION LOCATIONS ARE APPROXIMATE.
5. PROPOSED SAMPLING LOCATIONS ARE BASED ON INDIANA STATE PLANE, WEST ZONE, NAD 83.

LEGEND:

- HISTORICAL SAMPLING STATION
- PROPOSED SAMPLING STATION

STATION	NORTHING	EASTING
WB-4	2320646.20	2842817.79
WB-5	2320623.97	2842810.18
WB-6	2320601.74	2842802.56

N

25 0 25 50 75
(Scale in Feet)
HORIZONTAL SCALE

WEST BRANCH OF THE GRAND CALUMET RIVER
FIGURE 2-2
SAMPLE STATION LOCATIONS
(REACH 1 AND ROXANA MARSH)

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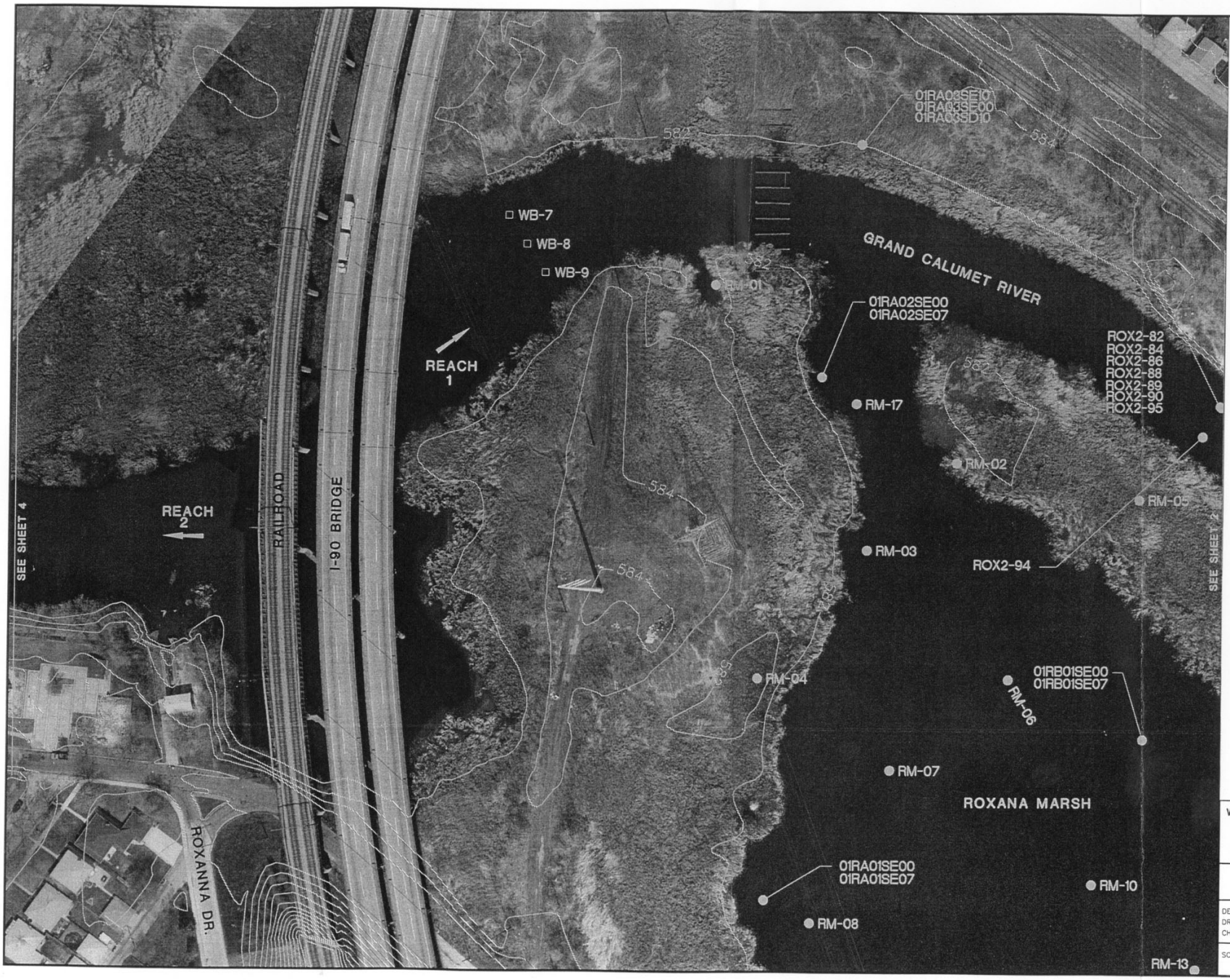

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4. HISTORICAL SAMPLING STATION LOCATIONS ARE APPROXIMATE.
5. PROPOSED SAMPLING LOCATIONS ARE BASED ON INDIANA STATE PLANE, WEST ZONE, NAD 83.

LEGEND:

● HISTORICAL SAMPLING STATION

□ PROPOSED SAMPLING STATION

STATION	NORTHING	EASTING
WB-7	2320453.52	2841821.09
WB-8	2320440.63	2841853.98
WB-9	2320427.74	2841886.86

25 0 25 50 75
(Scale in Feet)
HORIZONTAL SCALE

WEST BRANCH OF THE GRAND CALUMET RIVER
FIGURE 2-3
SAMPLE STATION LOCATIONS
(REACH 1 AND ROXANA MARSH)

FOSTER WHEELER ENVIRONMENTAL CORPORATION

DESIGNED: –	APPROVED	
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SCALE: AS NOTED	DRAWING NO. MGCABM01	3/12

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4. HISTORICAL SAMPLING STATION LOCATIONS ARE APPROXIMATE.
5. PROPOSED SAMPLING LOCATIONS ARE BASED ON INDIANA STATE PLANE, WEST ZONE, NAD 83.

LEGEND:

- HISTORICAL SAMPLING STATION
- PROPOSED SAMPLING STATION

STATION	NORTHING	EASTING
WB-10	2319704.52	2841015.20
WB-11	2319678.90	2841022.25
WB-12	2319653.28	2841023.92

N

25 0 25 50 75
(Scale in Feet)
HORIZONTAL SCALE

WEST BRANCH OF THE GRAND CALUMET RIVER
FIGURE 2-4
SAMPLE STATION LOCATIONS
(REACH 2)

FOSTER WHEELER ENVIRONMENTAL CORPORATION

DESIGNED: -
DRAWN: AEC
CHECKED: -
APPROVED
DATE: 9/20/02

SCALE: AS NOTED
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LEGEND:

● HISTORICAL SAMPLING STATION

□ PROPOSED SAMPLING STATION

STATION	NORTHING	EASTING
WB-13	2319891.84	2839931.07
WB-14	2319862.09	2839910.92
WB-15	2319832.35	2839890.77

N

25 0 25 50 75
(Scale in Feet)
HORIZONTAL SCALE

WEST BRANCH OF THE GRAND CALUMET RIVER
FIGURE 2-5
SAMPLE STATION LOCATIONS
(REACH 2)

FOSTER WHEELER ENVIRONMENTAL CORPORATION

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SCALE: AS NOTED	DRAWING NO. MGCABM01	5/12

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NOTES:

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2. EXISTING TOPOGRAPHIC DATA IS BASED ON MERRICK & CO. SURVEY (1996).
3. EXISTING SURVEY IS BASED ON INDIANA STATE PLANE NAD83.
4. HISTORICAL SAMPLING STATION LOCATIONS ARE APPROXIMATE.
5. PROPOSED SAMPLING LOCATIONS ARE BASED ON INDIANA STATE PLANE, WEST ZONE, NAD 83.

LEGEND:

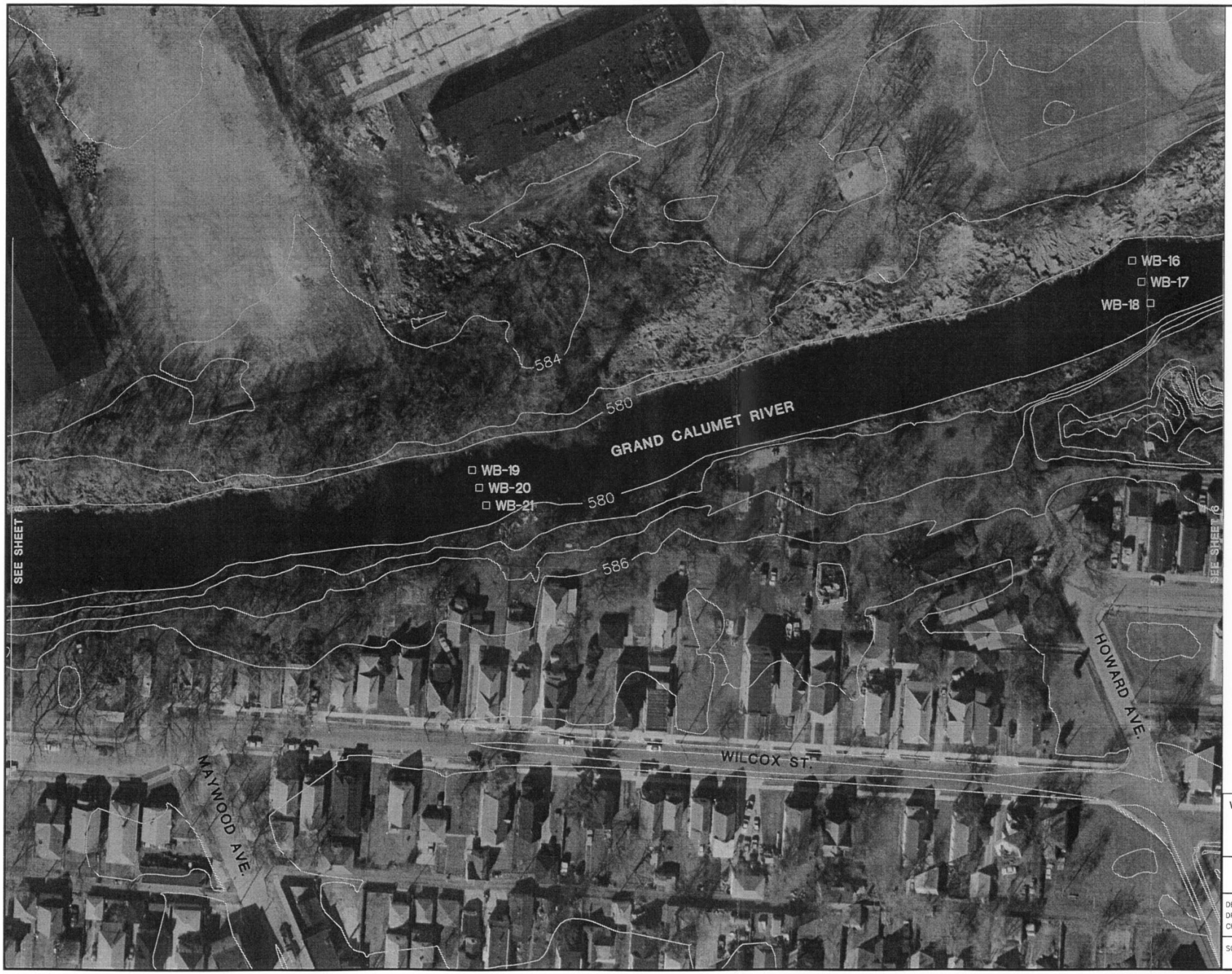
- HISTORICAL SAMPLING STATION
- PROPOSED SAMPLING STATION

25 0 25 50 75
(Scale in Feet)
HORIZONTAL SCALE

WEST BRANCH OF THE GRAND CALUMET RIVER
FIGURE 2-6
SAMPLE STATION LOCATIONS
(REACH 2 AND 3)

FOSTER WHEELER ENVIRONMENTAL CORPORATION

DESIGNED: –	APPROVED	
DRAWN: AEC		DATE: 9/20/02
CHECKED: –		
SCALE: AS NOTED	DRAWING NO. MGCABM01	6/12



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5. PROPOSED SAMPLING LOCATIONS ARE BASED ON INDIANA STATE PLANE, WEST ZONE, NAD 83.

LEGEND:

- HISTORICAL SAMPLING STATION
- PROPOSED SAMPLING STATION

STATION	NORTHING	EASTING
WB-16	2320836.01	2838222.65
WB-17	2320812.06	2838222.65
WB-18	2320788.12	2838222.65
WB-19	2320908.26	2837511.47
WB-20	2320888.53	2837510.90
WB-21	2320868.81	2837510.33

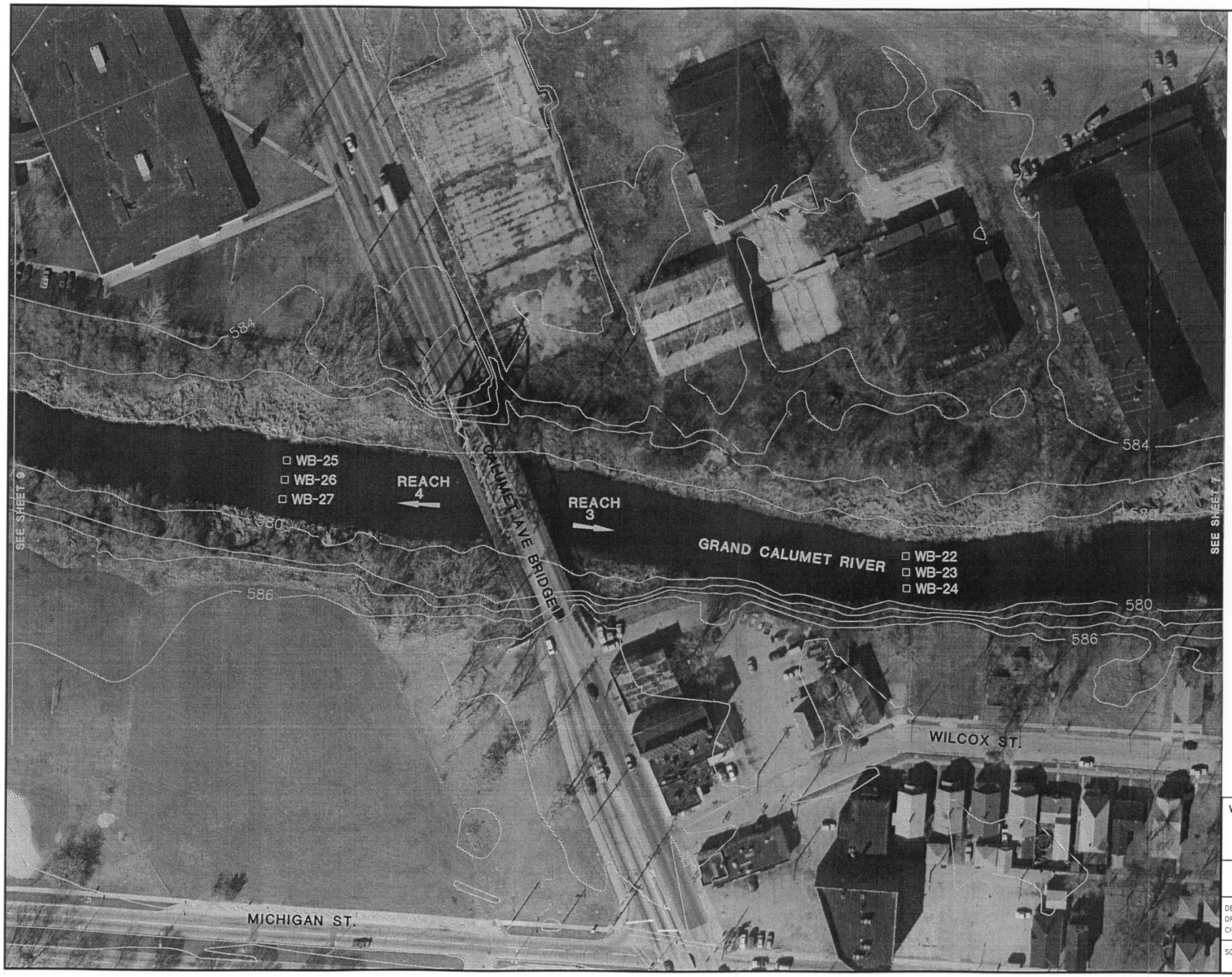
N

25 0 25 50 75
(Scale in Feet)
HORIZONTAL SCALE

WEST BRANCH OF THE GRAND CALUMET RIVER
FIGURE 2-7
SAMPLE STATION LOCATIONS
(REACH 3)

FOSTER WHEELER ENVIRONMENTAL CORPORATION

DESIGNED: –
DRAWN: AEC
CHECKED: –
APPROVED
DATE: 9/20/02
SCALE: AS NOTED
DRAWING NO. MGCABM01
7/12



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3. EXISTING SURVEY IS BASED ON INDIANA STATE PLANE NAD83.
4. HISTORICAL SAMPLING STATION LOCATIONS ARE APPROXIMATE.
5. PROPOSED SAMPLING LOCATIONS ARE BASED ON INDIANA STATE PLANE, WEST ZONE, NAD 83.

LEGEND:

- HISTORICAL SAMPLING STATION
- PROPOSED SAMPLING STATION

STATION	NORTHING	EASTING
WB-22	2321140.46	2836759.13
WB-23	2321124.80	2836752.89
WB-24	2321109.14	2836746.64
WB-25	2321485.54	2836210.37
WB-26	2321467.88	2836200.40
WB-27	2321450.22	2836190.42

N

25 0 25 50 75
(Scale in Feet)
HORIZONTAL SCALE

WEST BRANCH OF THE GRAND CALUMET RIVER
FIGURE 2-8
SAMPLE STATION LOCATIONS
(REACH 3 AND 4)

FOSTER WHEELER ENVIRONMENTAL CORPORATION

DESIGNED: –
DRAWN: AEC
CHECKED: –
APPROVED
DATE: 9/20/02
SCALE: AS NOTED
DRAWING NO. MGCABM01
8/12

NOT FOR CONSTRUCTION

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3. EXISTING SURVEY IS BASED ON INDIANA STATE PLANE NAD83.
4. HISTORICAL SAMPLING STATION LOCATIONS ARE APPROXIMATE.
5. PROPOSED SAMPLING LOCATIONS ARE BASED ON INDIANA STATE PLANE, WEST ZONE, NAD 83.

LEGEND:

- HISTORICAL SAMPLING STATION
- PROPOSED SAMPLING STATION

STATION	NORTHING	EASTING
WB-28	2321846.25	2835709.53
WB-29	2321830.50	2835701.17
WB-30	2321814.75	2835692.81

N

25 0 25 50 75
(Scale in Feet)
HORIZONTAL SCALE

WEST BRANCH OF THE GRAND CALUMET RIVER
FIGURE 2-9
SAMPLE STATION LOCATIONS
(REACH 4)

FOSTER WHEELER ENVIRONMENTAL CORPORATION

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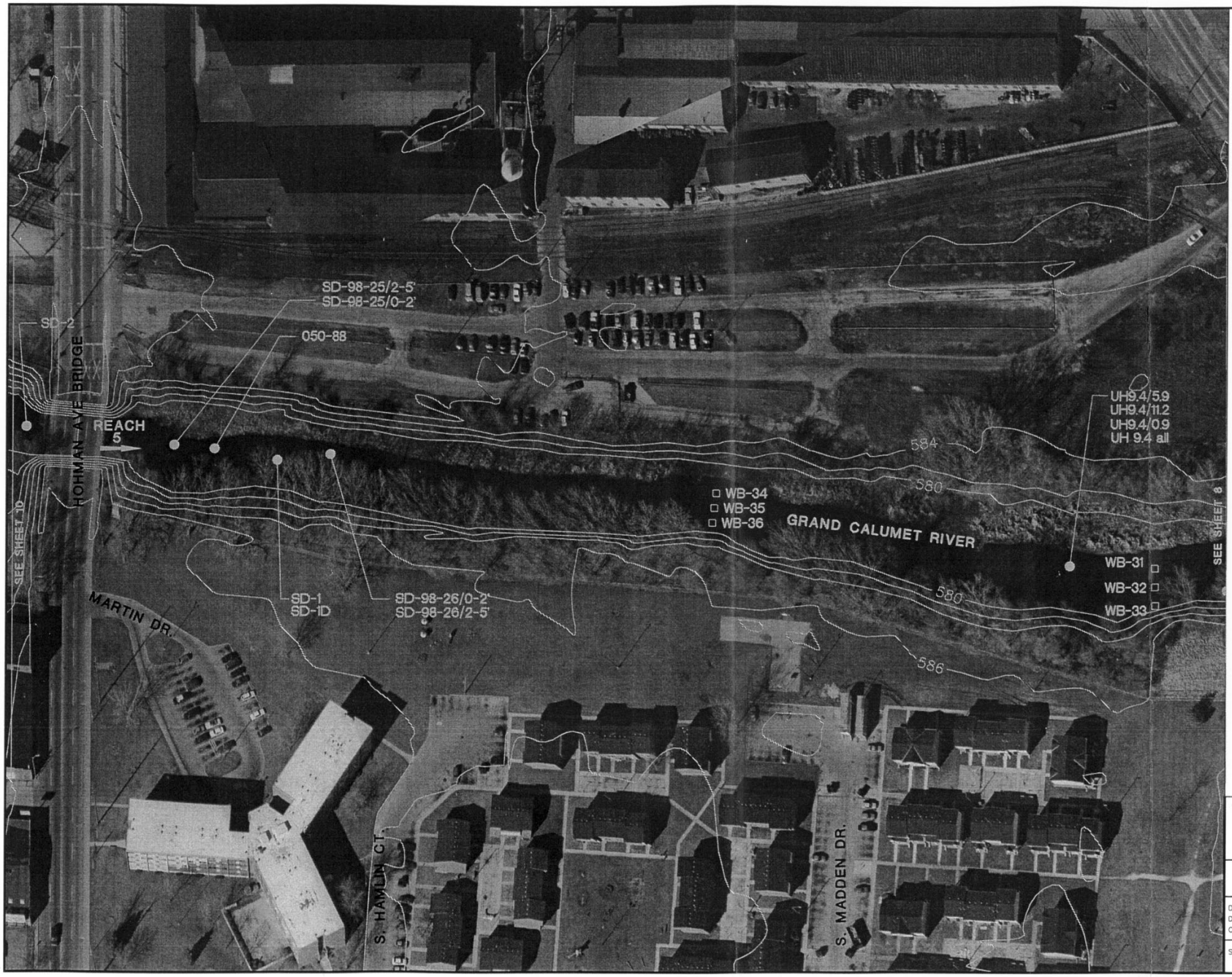
DRAWN: AEC		DATE: 9/20/02
CHECKED: –		
SCALE: AS NOTED	DRAWING NO. MGCABM01	9/12



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4. HISTORICAL SAMPLING STATION LOCATIONS ARE APPROXIMATE.
5. PROPOSED SAMPLING LOCATIONS ARE BASED ON INDIANA STATE PLANE, WEST ZONE, NAD 83.

LEGEND:

● HISTORICAL SAMPLING STATION

□ PROPOSED SAMPLING STATION

STATION	NORTHING	EASTING
WB-31	2322269.82	2834860.22
WB-32	2322251.78	2834852.72
WB-33	2322233.74	2834845.22
WB-34	2322521.87	2834476.14
WB-35	2322508.49	2834468.13
WB-36	2322495.11	2834460.13

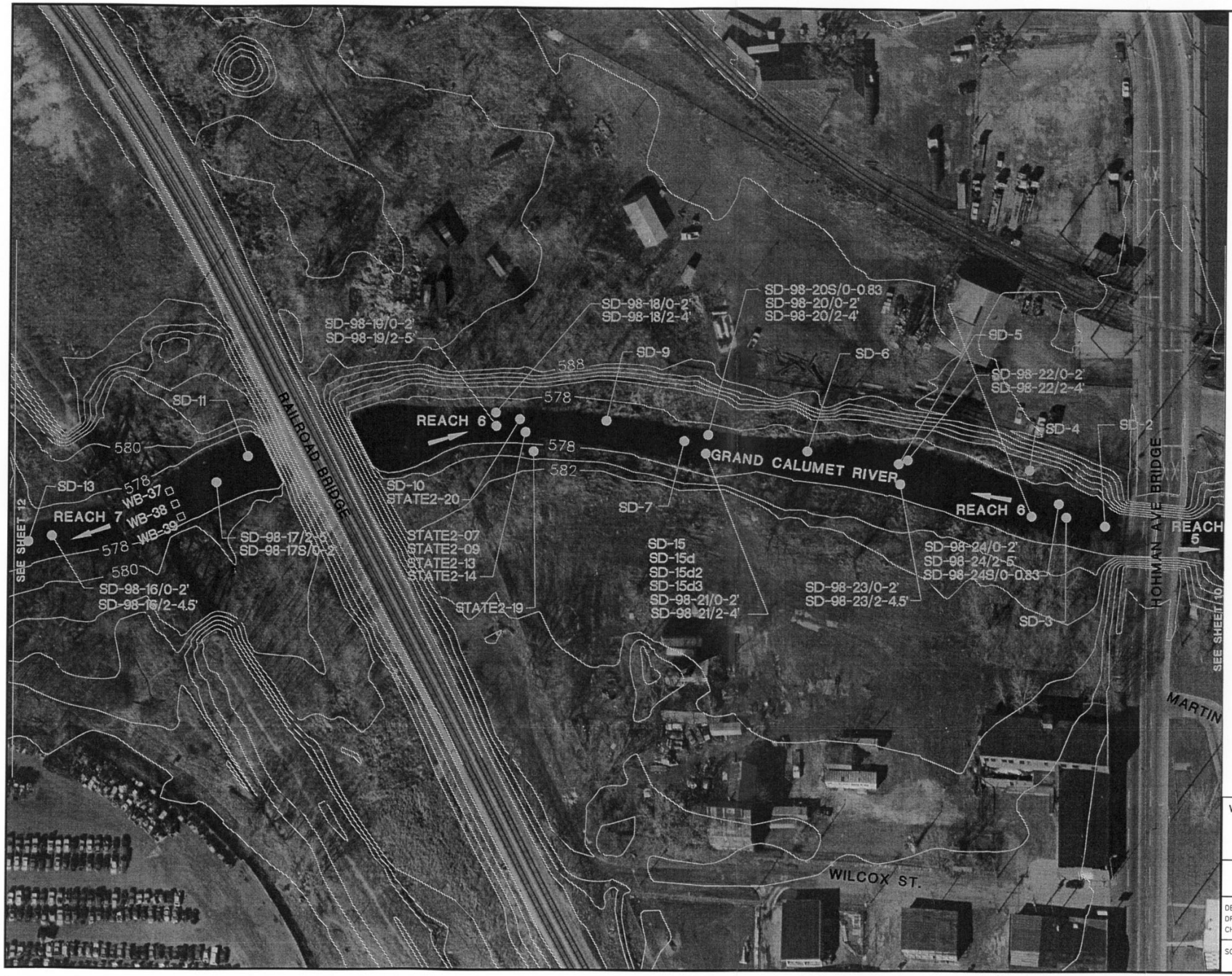
N

25 0 25 50 75
(Scale in Feet)
HORIZONTAL SCALE

WEST BRANCH OF THE GRAND CALUMET RIVER
FIGURE 2-10
SAMPLE STATION LOCATIONS
(REACH 5)

FOSTER WHEELER ENVIRONMENTAL CORPORATION

DESIGNED: –	APPROVED	
DRAWN: AEC		DATE: 9/20/02
CHECKED: –		
SCALE: AS NOTED	DRAWING NO. MGCABM01	10/12



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4. HISTORICAL SAMPLING STATION LOCATIONS ARE APPROXIMATE.
5. PROPOSED SAMPLING LOCATIONS ARE BASED ON INDIANA STATE PLANE, WEST ZONE, NAD 83.

LEGEND:

● HISTORICAL SAMPLING STATION

□ PROPOSED SAMPLING STATION

STATION	NORTHING	EASTING
WB-37	2323284.45	2832975.49
WB-38	2323269.86	2832975.80
WB-39	2323255.27	2832976.10

N

25 0 25 50 75
(Scale in Feet)
HORIZONTAL SCALE

WEST BRANCH OF THE GRAND CALUMET RIVER
FIGURE 2-11
SAMPLE STATION LOCATIONS
(REACH 6)

FOSTER WHEELER ENVIRONMENTAL CORPORATION

DESIGNED: –	APPROVED	
DRAWN: AEC		DATE: 9/20/02
CHECKED: –		
SCALE: AS NOTED	DRAWING NO. MGCABM01	11/12

NOT FOR CONSTRUCTION

DRAWING REDUCED HALFSIZE

NOTES:

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3. EXISTING SURVEY IS BASED ON INDIANA STATE PLANE NAD83.
4. HISTORICAL SAMPLING STATION LOCATIONS ARE APPROXIMATE.
5. PROPOSED SAMPLING LOCATIONS ARE BASED ON INDIANA STATE PLANE, WEST ZONE, NAD 83.

LEGEND:

- HISTORICAL SAMPLING STATION
- PROPOSED SAMPLING STATION

STATION	NORTHING	EASTING
WB-37	2323284.45	2832975.49
WB-38	2323269.86	2832975.80
WB-39	2323255.27	2832976.10
WB-40	2323434.93	2832088.37
WB-41	2323424.26	2832086.96
WB-42	2323413.60	2832085.54

N

25 0 25 50 75
(Scale in Feet)
HORIZONTAL SCALE

WEST BRANCH OF THE GRAND CALUMET RIVER
FIGURE 2-12
SAMPLE STATION LOCATIONS
(REACH 7)

FOSTER WHEELER ENVIRONMENTAL CORPORATION

DESIGNED: -
DRAWN: AEC
CHECKED: -
APPROVED
DATE: 9/20/02

SCALE: AS NOTED
DRAWING NO. MGCABM01
12/12

Table 2-1. Historical Sediment Sample Data

Substance	Units	Total No. Samples	Total No. Detects	Overall Average	Overall Standard Deviation	Overall Minimum	Overall Maximum	Location(s) of Overall Maximum(s)
Conventionals								
Acid volatile sulfides (µmol/g units)	µmol/g	2	2	354	276	159	550	UG-9
Acid volatile sulfides (mg/kg units)	mg/kg	2	2	11,350	8,863	5,086	17,620	UG-9
Ammonia-nitrogen	mg/kg	56	56	762	513	14	2,140	COL2-39
Percent clay sized particles	%	2	2	0.04	0.01	0.03	0.05	UG9 Top
Percent gravel sized particles	%	5	5	0	0	0	0	
Percent sand and gravel sized particles	%	2	2	83	16	71.4	94.4	UG10 Top
Percent sand sized particles	%	5	5	46	8.3	36.1	54.3	SD-98-20/2-4'
Percent silt + clay sized particles	%	5	5	54	8.3	45.7	63.9	SD-98-17/2-5'
Percent silt sized particles	%	2	2	17	16	5.53	28.5	UG9 Top
Metals								
Aluminum	mg/kg	59	59	9,653	4,224	2,800	25,100	087-94
Antimony	mg/kg	78	62	28	43	6	280	SOHL1-09
Arsenic*	mg/kg	123	87	27	35	0.96	210	RO5849
Barium	mg/kg	99	95	178	161	17	782	087-94
Beryllium	mg/kg	59	57	0.8	0.3	0.3	1.8	087-94
Boron	mg/kg	27	19	16	10	3.9	37	STATE2-09
Cadmium*	mg/kg	145	110	11	17	0.34	82	MOL2-48
Calcium	mg/kg	59	59	35,250	19,600	8,000	127,000	035-88
Chromium*	mg/kg	133	132	140	226	2.6	1,200	RO5847
Cobalt	mg/kg	59	57	10	3.4	3.1	18	ROX2-71
Copper*	mg/kg	124	122	194	202	4	1,000	UH9.2/1.1
Cyanide	mg/kg	47	26	2.3	2.9	0.1	12	SD-11
Iron	mg/kg	88	88	47,840	51,890	1,730	260,000	MOL2-70
Lead*	mg/kg	145	139	733	1,417	4.2	12,000	MOL2-70
Lithium	mg/kg	56	56	14	6.8	2.7	26	COL2-42
Magnesium	mg/kg	69	69	11,210	4,168	3,100	21,000	ROX2-84 ROX2-90

Table 2-1. Historical Sediment Sample Data (Continued)

Substance	Units	Total No. Samples	Total No. Detects	Overall Average	Overall Standard Deviation	Overall Minimum	Overall Maximum	Location(s) of Overall Maximum(s)
Manganese	mg/kg	69	69	704	448	190	2,860	050-88
Mercury*	mg/kg	67	53	1.2	1.4	0	5.1	RO5848
Molybdenum	mg/kg	56	50	6.2	7.4	1.3	39	MOL2-48
Nickel*	mg/kg	124	115	57	120	3.5	1,140	035-88
Potassium	mg/kg	78	53	920	465	210	2,100	COL2-42
Selenium	mg/kg	43	18	12.2	11.1	0.2	26.1	087-94
Silver	mg/kg	99	54	5.1	8.9	0.4	65	SOHL2-33
Sodium	mg/kg	59	57	941	1,729	170	11,000	STATE2-09
Strontium	mg/kg	56	56	50	20	14	130	STATE2-20
Thallium	mg/kg	3	1	5.0	2.4	2.3	6.5	050-88
Tin	mg/kg	75	55	67	86	2.7	359	01RC03SE00
Titanium	mg/kg	56	56	181	47	75	290	MOL2-70
Vanadium	mg/kg	59	58	23	9	8.6	49	MOL2-70
Zinc*	mg/kg	124	124	1,627	2,218	17	11,000	MOL2-70
Volatile Organic Compounds								
Benzene	µg/kg	59	32	9,615	14,920	5.5	50,000	SD-98-20/2-4' SD-98-24/0-2' SD-98-25/0-2'
Semivolatile Organic Compounds								
1,2,4-Trichlorobenzene	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
1,2,3,4-Tetrachlorobenzene	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
1,2,3,5-Tetrachlorobenzene	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
1,2-Dichlorobenzene	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
1,2-Dinitrobenzene	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
1,2-Diphenylhydrazine	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
1,3-Dichlorobenzene	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
1,3-Dinitrobenzene	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
1,4-Dichlorobenzene	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A

Table 2-1. Historical Sediment Sample Data (Continued)

Substance	Units	Total No. Samples	Total No. Detects	Overall Average	Overall Standard Deviation	Overall Minimum	Overall Maximum	Location(s) of Overall Maximum(s)
1,4-Dinitrobenzene	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
2,2'-Oxybis (1-chloropropane)	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
2,3,4,6-Tetrachlorophenol	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
2,4,5-Trichlorophenol	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
2,4,6-Trichlorophenol	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
2,4-Dichlorophenol	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
2,4-Dimethylphenol	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
2,4-Dinitrophenol	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
2,4-Dinitrotoluene	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
2,6-Dinitrotoluene	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
2-Chloronaphthalene	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
2-Chlorophenol	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
2-Methylnaphthalene	µg/kg	123	75	201,000	460,400	36	3,400,000	STATE2-07
2-Methylphenol	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
2-Nitroaniline	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
2-Nitrophenol	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
2-Picoline	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
3,3'-Dichlorobenzidine	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
3-Nitroaniline	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
4,6-Dinitro-2-methylphenol	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
4-Bromophenyl phenyl ether	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
4-Chloro-3-methylphenol	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
4-Chloroaniline	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
4-Chlorophenyl phenyl ether	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
4-Methylphenol	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
4-Nitroaniline	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
4-Nitrophenol	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Acenaphthene	µg/kg	123	75	133,900	268,400	330	1,400,000	SD-15d STATE2-07

Table 2-1. Historical Sediment Sample Data (Continued)

Substance	Units	Total No. Samples	Total No. Detects	Overall Average	Overall Standard Deviation	Overall Minimum	Overall Maximum	Location(s) of Overall Maximum(s)
Acenaphthylene	µg/kg	123	18	28,380	54,990	170	440,000	STATE2-07
Aniline	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Anthracene	µg/kg	123	81	54,460	92,950	140	540,000	STATE2-07
Benzidine	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Benzo(a)anthracene	µg/kg	132	86	41,420	64,430	-9	420,000	MOL2-68
Benzo(a)pyrene	µg/kg	142	81	40,270	56,440	20	330,000	SD-98-20/2-4'
Benzo(b)fluoranthene	µg/kg	5	5	53,000	27,230	28,000	99,000	RO5849
Benzo(g,h,i)perylene	µg/kg	4	4	46,500	29,190	23,000	89,000	RO5849
Benzo(k)fluoranthene	µg/kg	132	36	26,740	53,910	-9	440,000	STATE2-07
Benzoic acid	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Benzyl alcohol	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Bis(2-chloroethoxy)methane	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Bis(2-chloroethyl)ether	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Bis(2-ethylhexyl)phthalate	µg/kg	4	3	36,330	32,160	9,300	81,000	RO5848
Butylbenzylphthalate	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Carbazole	µg/kg	4	2	119,000	149,900	11,000	340,000	RO5850
Chrysene	µg/kg	132	91	53,750	97,120	-9	730,000	MOL2-68
Dibenz(a,h)anthracene	µg/kg	107	11	27,830	56,800	330	440,000	STATE2-07
Dibenzofuran	µg/kg	29	21	29,300	61,420	91	330,000	SD-98-20/2-4'
Diethylphthalate	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Dimethylphthalate	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Di-n-butyl phthalate	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Di-n-octylphthalate	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Fluoranthene	µg/kg	139	103	54,330	84,130	10	520,000	STATE2-07
Fluorene	µg/kg	123	79	61,010	102,500	330	590,000	STATE2-07
Hexachlorobenzene	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Hexachlorobutadiene	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Hexachlorocyclopentadiene	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Hexachloroethane	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A

Table 2-1. Historical Sediment Sample Data (Continued)

Substance	Units	Total No. Samples	Total No. Detects	Overall Average	Overall Standard Deviation	Overall Minimum	Overall Maximum	Location(s) of Overall Maximum(s)
Indeno(1,2,3-c,d)pyrene	µg/kg	107	25	27,750	56,610	330	440,000	STATE2-07
Isophorone	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Naphthalene	µg/kg	139	85	246,300	560,200	5.5	3,800,000	STATE2-07
Nitrobenzene	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
N-nitrosodimethylamine	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
N-nitrosodi-N-propylamine	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
N-nitrosodiphenylamine	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Pentachlorophenol	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Phenanthrene	µg/kg	135	114	192,700	345,400	130	1,900,000	STATE2-07 RO5849
Phenol (µg/kg units)	µg/kg	83	15	20,380	51,690	10	440,000	STATE2-07
Phenol (mg/kg units)	mg/kg	26	0	N/A	N/A	N/A	N/A	N/A
Pyrene	µg/kg	136	111	95,840	153,700	110	830,000	STATE2-07
Pyridine	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Tentatively identified compound	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Toluene-2,4-diamine	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Total HMW-PAHs (13 PAHs)	µg/kg	142	112	278,400	413,500	20	2,380,000	STATE2-07
Total HMW-PAHs**	µg/kg	128	112	276,600	410,600	20	2,236,000	MOL2-68
Total LMW-PAHs (13 PAHs)	µg/kg	139	117	757,700	1,633,000	1,120	11,850,000	STATE2-07
Total LMW-PAHs**	µg/kg	129	117	874,000	1,766,000	14	11,630,000	STATE2-07
Total PAHs (13 PAHs)	µg/kg	142	120	1,018,000	1,943,000	20	14,230,000	STATE2-07
Total PAHs**	µg/kg	134	120	1,106,000	2,067,000	20	13,790,000	STATE2-07
Unknown	µg/kg	4	3	612,700	351,700	251,900	1,030,000	RO5850
Polychlorinated Biphenyls								
Aroclor 1016	µg/kg	43	0	N/A	N/A	N/A	N/A	N/A
Aroclor 1221	µg/kg	43	0	N/A	N/A	N/A	N/A	N/A
Aroclor 1232	µg/kg	43	0	N/A	N/A	N/A	N/A	N/A
Aroclor 1242	µg/kg	43	4	3,813	12,060	33	80,000	SD-13
Aroclor 1248	µg/kg	59	18	5,382	11,050	-9	80,000	SD-13

Table 2-1. Historical Sediment Sample Data (Continued)

Substance	Units	Total No. Samples	Total No. Detects	Overall Average	Overall Standard Deviation	Overall Minimum	Overall Maximum	Location(s) of Overall Maximum(s)
Aroclor 1254	µg/kg	43	2	3,591	12,040	32	80,000	SD-13
Aroclor 1260	µg/kg	43	5	3,627	12,040	33	80,000	SD-13
Total PCBs	µg/kg	62	27	19,910	70,500	-9	560,000	SD-13
Total PCBs***	µg/kg	5	5	4,128	3,936	32	7,937	087-94
Pesticides								
Aldrin	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Chlordane	µg/kg	45	18	1,356	1,932	0.4	8,110	UG10 Bottom
Chlordane - alpha	µg/kg	26	2	172	357	1.7	1,700	01RC03SE00
Chlordane - gamma	µg/kg	26	0	N/A	N/A	N/A	N/A	N/A
Chlordane - reported****	µg/kg	2	2	2,160	28.3	2,140	2,180	UG-9
Dieldrin	µg/kg	45	17	1,971	2,990	0.4	10,900	UG9-C
Dieldrin only (Aldrin not measured)	µg/kg	4	2	1,089	1,512	3.4	3,210	UG-9
Endosulfan sulfate	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Endosulfan-alpha	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Endosulfan-beta	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Endrin	µg/kg	26	0	N/A	N/A	N/A	N/A	N/A
Endrin ketone	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Heptachlor (pesticide)	µg/kg	45	16	1,278	2,567	0.4	10,520	UG9 Middle UG9-B
Heptachlor + Heptachlor Epoxide***	µg/kg	2	2	955	1,082	190	1,720	UG-9
Heptachlor epoxide	µg/kg	26	0	N/A	N/A	N/A	N/A	N/A
Hexachlorocyclohexane - all isomers***	µg/kg	4	2	856	1,541	1.7	3,160	UG-9
Hexachlorocyclohexane-alpha	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Hexachlorocyclohexane-beta	µg/kg	4	1	55	37	32	110	RO5849
Hexachlorocyclohexane-delta	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
Lindane	µg/kg	45	17	670	1,125	0.4	4,160	UG9 Bottom UG9-C
Methoxychlor	µg/kg	4	0	N/A	N/A	N/A	N/A	N/A
o,p'-DDD	µg/kg	3	0	N/A	N/A	N/A	N/A	N/A

Table 2-1. Historical Sediment Sample Data (Continued)

Substance	Units	Total No. Samples	Total No. Detects	Overall Average	Overall Standard Deviation	Overall Minimum	Overall Maximum	Location(s) of Overall Maximum(s)
o,p'-DDE	µg/kg	3	0	N/A	N/A	N/A	N/A	N/A
o,p'-DDT	µg/kg	3	0	N/A	N/A	N/A	N/A	N/A
p,p'-DDD	µg/kg	35	10	298	629	-9	3,400	01RC03SE00
p,p'-DDE	µg/kg	35	9	2,039	3,564	3.4	14,690	UG10 Middle
p,p'-DDT	µg/kg	35	10	663	960	3.4	3,400	01RC03SE00
Sum DDD	µg/kg	1	1	60		60	60	UH 8.5
Sum DDD***	µg/kg	2	2	94	119	10	179	087-94
Sum DDE	µg/kg	1	1	4,360		4,360	4,360	UH 8.5
Sum DDE***	µg/kg	2	2	3,680	1,372	2,710	4,650	UG-9
Sum DDT	µg/kg	1	1	1,200		1,200	1,200	UH 8.5
Sum DDT***	µg/kg	2	2	920	1,174	90	1,750	UG-9
Total DDT	µg/kg	45	23	4,467	6,001	1.3	19,970	UG9-B
Total DDT***	µg/kg	3	3	3,130	3,129	178.6	6,410	UG-9
Total DDT**	µg/kg	33	23	5,345	6,614	1.3	19,970	UG9-B
Toxaphene	µg/kg	43	16	6,138	11,200	0.4	67,000	01RC03SE00
Dioxins								
2,3,7,8-Dibenzo-p-dioxin	µg/kg	10	3	00.0027	0.0018	0.0000073	0.0061	UG9-A

* Heavy metal

** Excluding values with DL>PEC (MacDonald and Ingersoll, 2000)

*** Using the Human Health calculations (MacDonald and Ingersoll, 2000)

**** Using the Human Health exclusion (MacDonald and Ingersoll, 2000)

Source data is located in Appendix D.

Non-detected analytes were factored into the statistical data and valued at the reported detection limits.

3. SAMPLING AND ANALYSIS

This section presents the proposed field and laboratory methodology for completing the bathymetry, topography and sampling Phase 2 tasks. The objective of the bathymetry/ topography surveys is to establish the topography of the riverbed and banks, and adjacent uplands. The primary objective of the sediment sampling and analysis is to provide spatial resolution of contaminant distribution and collection of toxicity information necessary to develop and evaluate restoration alternatives in this portion of the GCR. Together, these data will be used to identify areas and volumes of sediment that may require active remediation or that may be appropriate for restoration.

3.1 SEDIMENT CHEMICALS OF POTENTIAL CONCERN

Sediment samples will be analyzed for the contaminants of concern and conventional parameters listed in Table 3-1.

Table 3-1. Contaminants of Concern and Conventional Parameters

Analytical Parameter	Analytical Method
PCB Aroclors	SW-846 method 8082
PCB Congeners	SW-846 method 8082
Organochlorine Pesticides	SW-846 method 8081A
Semivolatile Organics	SW-846 method 8270C
Metals (RCRA = As, Ba, Cd, Cr, Pb, Hg, Se, Ag)	SW-846 methods 6010B Trace: 7471 A
Oil and Grease	SW-846 method 9071B
Total Organic Carbon	SW-846 method 9060 modified
Acid volatile sulfides – simultaneously extracted metals (AVS-SEM)	EPA draft method 1629/SW-846 method 1610B/7470

3.2 SAMPLING LOCATIONS AND DEPTHS

Sediment sampling is proposed at 42 locations as shown in Figures 2-1 through 2-12 and summarized in Table 3-2. Sample locations are distributed along transects of two to three locations within each of six river reaches. Foster Wheeler Environmental identified the approximate locations after review of the historical data available for the 2-1/2 miles of the river (Foster Wheeler Environmental 2002a). Based on this review, additional chemical data are required to evaluate the nature extent of contamination in River Reaches 1, 2, 3, 4, 5 and 7. There are extensive surface and subsurface sediment data for Reach 6, which is located between the Hohman Avenue Bridge and the railroad bridges to the east (Figure 2-11).

Table 3-2. Proposed Phase 2 Station Locations (State Plane Indiana West NAD 83)

Station Number	Northing	Easting
WB-1	2319560	2843667
WB-2	2319549	2843626
WB-3	2319538	2843586
WB-4	2320646	2842818
WB-5	2320624	2842810
WB-6	2320602	2842803
WB-7	2320454	2841821
WB-8	2320441	2841854
WB-9	2320428	2841887
WB-10	2319705	2841015
WB-11	2319679	2841022
WB-12	2319653	2841024
WB-13	2319892	2839931
WB-14	2319862	2839911
WB-15	2319832	2839891
WB-16	2320836	2838223
WB-17	2320812	2838223
WB-18	2320788	2838223
WB-19	2320908	2837511
WB-20	2320889	2837511
WB-21	2320869	2837510
WB-22	2321140	2836759
WB-23	2321125	2836753
WB-24	2321109	2836747
WB-25	2321486	2836210
WB-26	2321468	2836200
WB-27	2321450	2836190
WB-28	2321846	2835710
WB-29	2321831	2835701
WB-30	2321815	2835693
WB-31	2322270	2834860
WB-32	2322252	2834853
WB-33	2322234	2834845
WB-34	2322522	2834476
WB-35	2322508	2834468
WB-36	2322495	2834460
WB-37	2323309	2832778
WB-38	2323299	2832778
WB-39	2323289	2832778
WB-40	2323435	2832088
WB-41	2323424	2832087
WB-42	2323414	2832086

Initial sample locations may be modified in the field based on site-specific conditions (e.g., to avoid an underground utility). Approximate sample locations proposed for Phase 2 and historical sampling locations are shown in Figures 2-1 through 2-11.

Sediment sampling will be performed at 42 stations to determine the depth of sediments that may require remediation. Core depth is expected to range from 8 feet to a maximum of approximately 12 feet, or refusal. The primary objective of the subsurface sediment samples is to determine the vertical extent of sediment requiring remediation. Each subsurface core will be logged in the field using the visual-manual classification methods of American Society for Testing and Materials (ASTM) D 2488. Sediment sample intervals will be collected for analysis of parameters listed in Table 3-1. Sample intervals will generally correspond to sediment stratigraphy (e.g., if a major sediment layer occurs from 0 to 8 feet, the likely sample interval will be 0 feet to 4 feet and 4 feet to 8 feet). The last core interval should be native material in order to determine the depth of clean sediment. A minimum of two, and not more than four, composited samples will be taken from each sample location. If multiple sediment strata are encountered, additional sediment intervals will be collected and archived for future analysis, if needed.

3.2.1 Utility Survey

Foster Wheeler Environmental will locate and mark proposed sampling locations using a Trimble AG 132 differential Global Positioning System (DGPS). Prior to Commencing Intrusive Field Activities, Foster Wheeler Environmental will conduct a utility survey to identify all known underground utilities within the study area. Foster Wheeler Environmental will utilize the information provided in the *Grand Calumet River/Indiana Harbor Ship Canal Sediment Sampling Project – Draft Utility Survey Results* (Maxim Technologies, 1999) as the baseline for the utilities survey. If proposed sample locations interfere with utilities, alternate locations will be marked.

Based on the results of the Draft Utilities Survey, up to four underground utilities are known to be present within, or near, the study area. These include two 16-inch pipelines owned by Wolverine Pipeline (815-838-8160), one pipeline owned by the Amoco Pipeline Company (219-234-4844), and one buried cable bundle owned by Ameritech Telephone Company (219-730-0881).

Foster Wheeler Environmental has contacted or will contact each of the utilities known to have pipelines/cables present in, or near, the study area prior to mobilization to confirm the pipeline/cable locations as listed below.

Wolverine Pipeline: Foster Wheeler Environmental contacted Mr. Scott Smith at Wolverine Pipeline (815) 838-8160. He will meet field personnel on site for flagging with a call a few days prior to site visit as a backup to the one call service.

Ameritech: Foster Wheeler Environmental contacted Mr. Mike Brandon (219) 662-4402. They do have a cable in the area. It shows on his map as being between 24 and 58 feet below ground. They handle all locates through the one call service, and will meet field personnel on site through that contact.

Amoco/Badger Pipeline: Foster Wheeler Environmental contacted Amoco/Badger regarding their pipeline at 1-800-806-2449. They are across the highway from the project site, but are willing to mark pipeline if needed through the one call service.

In addition, Foster Wheeler Environmental will contact the Indiana Underground Plant Protection Service or "one-call service" at 1-800-382-5544 a minimum of two business days prior to the start of field activities. A Foster Wheeler Environmental representative will attend an on-site meeting with the utility locator(s) to have the locations of all known underground marked and also recorded on a site map.

All overhead utilities will be avoided in a manner to provide a minimum of a 15-foot distance between overhead utilities and all sampling equipment.

3.2.2 Horizontal and Vertical Location Control

Proposed sediment sampling stations will be located using a positioning system consisting of a Trimble AG 132 DGPS and a computer running HYPACK® hydrographic survey software or comparable software. This system will provide sub-meter positioning accuracy. Stations will be located prior to sampling and marked with a stake. If it is necessary to move a station, the new location will be marked and staked as described above.

To maintain system accuracy, a land surveyor will establish two or more accessible and recoverable survey control points in each river reach. The control points will be located at the base of a bridge or culvert where a staff gauge(s) will be installed (refer to Section 3.3.4). At the beginning and end of each day, the crew will position the DGPS antenna on the control point, record the differentially corrected coordinates, and compare them to the known land-survey coordinates. The recorded coordinates must be within 2 meters of the known coordinates, which is the approximate accuracy of the DGPS. Northing and easting will be recorded in State Plane Indiana West, NAD 83 coordinate system to the nearest 0.1 foot.

Vertical control parameters measured for all sediment sampling include depth to sediment if there is overlying water at a sample location and river surface elevation. The depth to sediment will be measured before each sampling event, using a hand-held, weighted tape. The incremented weighted tape will be dropped to the bottom, pulled taut, and read to the nearest 0.1 foot.

After sampling is completed, using control points established by the land surveyor, the elevation of each sample point will be determined by lead line and water elevations. Station elevations will be corrected to Low Water Datum or to a fixed U.S. Geological Survey (USGS) elevation benchmark.

The following parameters will be documented at every sample location:

- Horizontal location in NAD 83 state plane coordinates, as appropriate
- Depth to mudline (if overlying water)
- Time and date
- surface elevation referenced to National Geodetic Vertical Datum (NGVD)

Parameters listed above will be measured using combinations of the following:

- DGPS
- Range-azimuth laser positioning methods
- Sounding lines or poles
- Back-up methods to survey control points (e.g., horizontal triangulation)

3.3 BATHYMETRY SURVEY

Bathymetric work in support of the characterization of the WBGCR shall be conducted in accordance with the requirements and guidelines specified for navigation and dredging support surveys in U.S. Army Corps of Engineers (USACE) Engineer Manual (EM) 1110-2-1003 (2002). This section details the project-specific requirements of the surveys within those broader guidelines.

3.3.1 Water Depth Greater than 2 Feet

In open areas where DGPS positioning is reliable and boat access is available, depths will be measured using an Innerspace 448 single-frequency precision depth recorder (PDR), with

shallow water modifications, and a Trimble AG 132 DGPS or similar unit capable of providing location coordinates to an accuracy of ± 2.0 meters. The DGPS and PDR will be deployed from a shallow-draft boat equipped with a motor. Data collected by the DGPS and PDR will be recorded with HYPACK® hydrographic survey software, which will also provide navigation to the boat operator. Positions will be differentially corrected in real-time using a signal broadcast from either U.S. Coast Guard beacon, a National Geodetic Survey continuously operating reference station (CORS) or a commercial satellite. Alternatively, if a governmental or commercial broadcast is unavailable, a DGPS base station will be established onsite and operated during the field program. If necessary, the DGPS base station will be established at an existing control point and a telemetry system used to radio base station-generated corrections to the roving DGPS unit.

At the beginning of each day the DGPS is used, its accuracy shall be verified by comparing the position reported by the DGPS unit to a position of known accuracy (i.e., surveyed control points). Any discrepancy greater than ± 2.0 meters between the reported and actual positions shall be resolved prior to surveying. As required by the USACE Engineer Manual EM 1110-2-1003 a minimum of two bar checks will be conducted each day that hydrographic surveying is conducted, one prior to the start of the survey and one after completing surveying for the day. Calibrations will be conducted at 5-ft intervals or a minimum of two depths, if the water depth in the project area does not exceed 10-ft. These depths will be dependent on the depth of the river where surveying is being conducted.

3.3.2 Water Depth Less than 2 Feet

In areas where the water is too shallow to use the PDR, an inflatable boat or small flat-bottom boat and manual depth measurement will be used to measure depths. The boat will be pulled along a tag line stretched across the river at the survey location. If possible, the endpoints of the tagline will be at existing survey control points. If there are no anchor points for the tagline and anchors can not be placed at the planned survey line location, the boat will be pushed with a pole, or the survey line will be moved to the nearest possible location with satisfactory anchor points.

The position of each sounding will be determined using the DGPS. Alternatively, a survey tape measure will be attached to the tag line to determine sounding distances from the control point serving as the origin of the cross section. The origin of each line surveyed in this method will be on the left bank of the river. Soundings will be taken at intervals no greater than 25 feet and no less than 5 feet. The spacing of the soundings will be dependent

upon the shape of the river cross section. In areas where the cross section shows little change in depth with distance, fewer soundings may be taken. In areas of greater variability, more closely spaced measurements will be required. The information recorded for each sounding will include, at a minimum time, depth to mudline, northing, easting. If a survey tape and tag line are used to determine measurement locations than cross-section identifier and distance downline on the tagline will also be recorded.

At each sounding location, depth will be measured using either a lead line, composed of an 7- to 8-pound mushroom anchor with a 6-inch diameter crown attached to a survey tape measure or a survey control rod with a 6-inch diameter plate attached to its base. For manual depth measurements, water surface elevations will be measured using a staff gauge installed at either end of the river reach (e.g., at the base of the bridge or culvert). Staff gauges will be located at control points established by registered land surveyors prior to beginning the bathymetry survey.

Depths will be measured along cross sections set 100 feet apart. Cross section spacing may be adjusted in the field based on conditions at the time of the survey such as accessibility, safety, and river flow. Line spacing shall not exceed 250 feet. In addition to the planned lines, cross-sections will be surveyed at significant features such as bridges and culverts.

3.3.3 Water Surface Elevation

Water levels will be measured using a combination of staff gauges and boards installed by surveyors at the end of each river reach. A staff gauge or board with marked increments of 0.1 feet and major increments that correspond to the local vertical datum will be placed in each reach. These gauges and boards will remain in place for the duration of the project and be attached to the pilings of the bridges or culverts that delineate the reaches. The staff gauges or boards will be monitored and recorded at least every hour and more frequently if changes in the river flow or shoreline level are observed.

3.4 TOPOGRAPHIC SURVEY

A survey firm licensed in Indiana will conduct a full-coverage topographic survey of the West Branch of the Grand Calumet River study area. The survey area will extend from the Indianapolis Boulevard Bridge to the Indiana-Illinois State Line and from the waterline of the river up to a hard surface elevation such as a road or building. If no such features exist, the survey will extend approximately 200 feet from the waterline.

The survey will include x, y, z, and descriptions of a sufficient number of points to allow the generation of accurate topographic maps of the study area. In addition to the points used to generate topographic contours, all other significant topographic features within the survey area will be mapped. This includes man-made features such as drainage ditches and roads, and natural features, such as ridges, streambeds, and breaks in slope. The topographic survey will supplement the contours on the aerial photographs used on the base maps.

The surveyors will also mark elevations on the pilings of each bridge in the survey area and the top of each culvert (both ends) that separates the reach. These marks will be used as references for the staff gauges that will be used to monitor water levels in each reach. At least two pilings on each bridge should be marked so that staff gauges may be placed that can be viewed from either upstream or downstream.

The surveyors will also be available to support the efforts of the bathymetry survey that will be taking place concurrently. This may include determining the coordinates of cross section endpoints in areas of poor DGPS coverage. At the completion of the topographic survey, the surveyors will provide an electronic drawing and data file listing the northing, easting, elevation, and description of each survey point as well as a definition of point descriptors. All elevation data shall be referenced to MSL. All horizontal positions shall be in Indiana State Plane, West Zone, NAD 83 coordinates.

3.5 SEDIMENT CHEMICAL SAMPLING

Sediment chemical characterization will consist of composite core increments from 42 locations within the six river reaches. It is estimated that a total of 84 environmental samples will be submitted to the laboratory. Each sample will be analyzed for the parameters listed in Table 3-1 by Severn Trent Laboratories (STL) in University Park, Illinois.

In addition, 4 composite samples will be selected from the 42 locations for elutriate testing. Representative portions of each composite will be analyzed for the parameters listed in Table 3-1 (with the exception of oil and grease and AVS-SEM). However, these samples will be sent to Soil Technologies, Inc. (STI) for analysis by Columbia Analytical Services of Kelso, Washington.

Additional sediment is required for laboratory quality assurance (QA) samples (i.e., matrix spikes). Matrix spikes (MS)/matrix spike duplicates (MSD) will be collected and analyzed at a frequency of 1 per 20 field samples. Field duplicates will also be collected periodically

throughout the sampling program at a frequency of 1 per 20 field samples. Equipment rinse blanks will be collected once for every type of sediment collection method (i.e., one for sulfur grabs and one for cores). Additional field and lab QA samples will be collected as summarized in Table 3-4.

3.6 SEDIMENT GEOTECHNICAL SAMPLING

There is also insufficient geotechnical data to evaluate the engineering properties of the sediment that will be needed for remedial alternatives analysis and design. The sediment characteristics will help in determining the range of dredging equipment and the capacity of the sediments to support equipment. Sediment samples from approximately 20 coring locations will be selected for geotechnical testing. Selected samples from these cores will be analyzed for the parameters listed in Table 3-3 by STI of Bainbridge Island, Washington.

Table 3-3. Geotechnical and Water Quality Testing

Geotechnical and Water Quality Test	Testing Method
Grain Size	ASTM Method D 422-63 with hydrometer
Atterburg Limits	ASTM D 4318-95
Specific Gravity	ASTM D 854-92
Moisture Content/Bulk Density	ASTM D 2216
Laboratory UU Triaxial Shear	ASTM D 2850-95 with mod. in USEPA/USACE 1998
Consolidation	ASTM D 2435-90 with mod. by USACE for lower loads
Direct Shear	ASTM D 3080
Column Settling	USEPA/USACE 1998
Dredge Elutriate Test	DiGiano et al., 1995
Modified Elutriate Test	USEPA/USACE 1998

3.7 SURFACE WATER SAMPLING

Surface water samples will be collected from representative locations in the river as supply water for the column settling and elutriate tests. The water will be collected below the water surface but above the bottom using a peristaltic pump with weighted Teflon-lined tubing. A total of 60 liters of water is required for each column settling test. Approximately 4 liters of water are required for the elutriate testing at each location. Water for the column settling test will be stored in pre-cleaned polyethylene containers. Water for chemical and elutriate testing will be collected and stored in 1-liter amber glass bottles. The bottles will be shipped to STI and analyzed for the parameters listed in Table 3-3 (column settling and elutriate tests) and Table 3-4 (baseline chemical testing of surface water). Representative surface water collected and used in the elutriate testing will be analyzed in duplicate for both dissolved and total contaminants of concern listed in Table 3-5.

Table 3-4. Sampling and Analysis Summary for the WBGCR

Sample Matrix	Laboratory Analysis	No. of Samples*	Field QA Samples		Lab QA Samples	Total
			Environmental Duplicates	Equipment (Rinsate) Blanks	MS/MSD Samples	
Sediment						
	Semivolatile Organics	88	5	5	5/5	108
	Chlorinated Pesticides	88	5	5	5/5	108
	PCB Aroclors	88	5	5	5/5	108
	PCB Congeners	17	1	1	1/1	21
	RCRA Metals	88	5	5	5/5	108
	Oil and Grease	84	5	5	5/5	104
	TOC	88	5	5	5/5	108
	AVS-SEM	84	5	5	5/5	104
	Grain Size	50	3	NA	NA	53
	Atterburg Limits	25	1	NA	NA	26
	Specific Gravity	25	1	NA	NA	26
	Moisture Content/Bulk Density	25	1	NA	NA	26
	Laboratory UU Triaxial Shear	14	NA	NA	NA	14
	Consolidation	14	NA	NA	NA	14
	Direct Shear	7	NA	NA	NA	7
	Dredge Elutriate Test	4	NA	NA	NA	4
	Modified Elutriate Test	4	NA	NA	NA	4
	Column Settling	2	NA	NA	NA	2
Water						
	Total Semivolatile Organics	10	NA	NA	1/1	12
	Dissolved Semivolatile Organics	10	NA	NA	NA	10
	Total Chlorinated Pesticides	10	NA	NA	1/1	12
	Dissolved Chlorinated Pesticides	10	NA	NA	NA	10
	Total PCBs	10	NA	NA	1/1	12
	Dissolved PCBs	10	NA	NA	NA	10
	Total RCRA Metals	10	NA	NA	1/1	12
	Dissolved RCRA Metals	10	NA	NA	NA	10
	DOC	10	NA	NA	1/1	12
	TOC	10	NA	NA	NA	10
	Total Suspended Solids	10	NA	NA	NA	10

* Estimated number of samples. Actual number will change during field activities. Additional subsurface sediment samples may be archived. The number of environmental duplicates and MS/MSD samples will be dependent on the number of field samples collected, and shall be analyzed at a rate of 5 percent (1 per 20).

Table 3-5. Surface Water Quality Testing

Analytical Parameter	Analytical Method
PCB Aroclors	SW-846 method 8082
Organochlorine Pesticides	SW-846 method 8081
Semivolatile Organics	SW-846 method 8270C
Metals (RCRA[1] = As, Ba, Cd, Cr, Pb, Hg, Se, Ag)	EPA 200.10/200.12/200.13 and EPA 245.2 or equivalent
Dissolved Organic Carbon	EPA 415.1
Total Organic Carbon	EPA 415.1
Total Suspended Solids	EPA 160.2

1 RCRA = Resource Conservation and Recovery Act

3.8 BIOASSAY TESTING

Sufficient sample volume (i.e., 1 liter) of selected composite samples will be collected and sent to U.S. Geological Society Biological Research Division in Columbia, Missouri for sediment toxicity testing. A 28-day survival and growth test using *Hyalella azteca* will be performed. A total of 42 samples will be tested during the Phase 2 sampling effort.

3.9 SEDIMENT SAMPLE COLLECTION METHODS

3.9.1 Sediment Cores

Subsurface sampling will be performed using a vibracore coring system as the primary sample collection system. The vibracore uses a hydraulic or electric system that vibrates and drives a length of 4-inch outer diameter (OD) aluminum or steel tube into the sediment. A continuous sediment sample is retained within the tube liner with the aid of a stainless steel core cutter/catcher. Prior to sampling, each core tube, liner and catcher will be decontaminated following the procedures outlined in Section 3.12 or a new decontaminated core and catcher will be used for each sample.

The vibracore coring system should be capable of collecting a continuous core to the maximum sediment depth expected at the site of 12 feet. The standard 4-inch diameter core tube will provide a sufficient volume of sediment for analysis of intervals of less than 5 feet. Vibracore sampling procedures are outlined in standard operating procedure (SOP) 4 of Appendix A and in the following paragraphs.

Depth of penetration versus depth of recovery will be closely monitored during the collection of the cores. The in situ depth to the top of the section will be recorded for each section, if sectioning of the core is required. After removing the core from the drive head, but before the tube is cut, the tube will be marked with an indelible marker identifying the

station and core section and may be wrapped with transparent tape to prevent loss or damage of the marking. The core and core sections will be labeled with the boring number and the top and bottom sample depths below the mudline.

Sediment at the end of each tube section will be visually classified for qualitative sample characteristics. Changes from the top to the bottom of each section of the tube will be noted and recorded on the core log sheet. Empty tubing will be removed to assure that each section is full of sediment. The core ends will then be covered with aluminum foil, a protective cap, and duct tape to prevent leakage. The core sections will be stored upright in a container chilled with ice to approximately 4°C. A full tube will limit disturbance during storage and transport.

If core liners are used, the core tubes will not be cut. The core liner containing the sediment will be removed from the core tube. The core liner will be sealed by tying, taping, or other appropriate means and the core placed on ice. The core tube will then be rinsed and a new core liner and core catcher will be installed.

Minimal processing of the samples will occur within the river reach. As soon as possible after collection, the cores will be transported to an onshore area for sample processing and subsampling. If problems are discovered during sectioning, another core may need to be taken at the station. The Field Operations Leader (FOL) will consult with the Project Manager (PM) and make a decision as soon as possible if a problem is discovered.

3.9.1.1 Core Sample Acceptability

As the core is pulled from the water, it will be visually evaluated for penetration and release of sediment from the tube. Caution will be used to prevent disturbance of the surface of the sediment when the core is laid at an angle during removal from the drive head. The core catcher will be inspected for rocks or other obstacles that may have plugged the core while penetrating. A core may be rejected if there is doubt about its representativeness. The actual penetration depth and sample recovery will also be compared and documented. A sample recovery of 75 percent or greater will be considered acceptable and representative of an individual location.

Sediment depth and sample characteristics in the core will be used to determine if the desired depth has been sampled. If recovery is below 75 percent or the core shows signs of disturbance, another core may be attempted at that station. The longer core of the two will be analyzed. The second core will be retained in case problems such as excessive

disturbance are discovered during the core cutting procedure. Secondary cores will not be used if the first core is acceptable.

3.9.1.2 Core Compaction

Compaction will be estimated (measured recovery/penetration) and will be used to determine in situ sampling depths. Recovered cores of at least 75 percent will be "expanded" to their penetration depth to compensate for core compaction.

3.10 WATER SAMPLE COLLECTION METHOD

Surface water will be collected in 2.5-gallon polyethylene carboys and 1-liter glass and 500-mL plastic bottles. Water will be collected from approximately 6-inches to 1-foot below the water surface using a portable peristaltic pump equipped with Teflon-lined tubing. The containers of water will be delivered to STI and stored in their refrigerator at approximately 4°C until the initiation of elutriate and column settling testing. Sample bottles (1-liter and 500-milliliters [mL]) will be delivered to Columbia Analytical Services (CAS) of Kelso, Washington for chemical analysis for contaminants of concern listed in Table 3-5. Until delivery to STI, water carboys and bottles will be stored in coolers at the field processing area at approximately 4°C.

3.11 SAMPLE DESIGNATION AND PROCESSING

Sediment samples will be assigned an individual sample identification number in the following manner:

FW-WB-##-CS-## - ##

Where: FW = Foster Wheeler Environmental

WB-## = WBGCR Station ID

CS = Core sediment

- ## = top and bottom depth increment in feet

Sediment sample processing will occur at an on-shore processing station as described in the following sections. Sample processing methods are intended to result in high quality samples that meet the program's quality assurance objectives. Guidelines for sampling handling and storage are presented in Table 3-6. All samples will be placed immediately in

Table 3-6. Required Containers, Preservatives, and Holding Times

Analysis Type	Matrix	Container Size	Holding Time[1]	Preservation
			14 days extraction/40 days analysis	Ice (4°C)
SVOCs	Sediment	8 oz glass	1 year until analysis	Frozen (-18°C)
			14 days extraction/40 days analysis	Ice (4°C)
PCBs	Sediment	8 oz glass	1 year until analysis	Frozen (-18°C)
			14 days extraction/40 days analysis	Ice (4°C)
Pesticides	Sediment	8 oz glass	1 year until analysis	Frozen (-18°C)
			6 months/28 days*	Ice (4°C)
RCRA Metals	Sediment	4 oz glass	2 years until analysis (except mercury)	Frozen (-18°C)
Oil and Grease	Sediment	4 oz glass	28 days	Ice (4°C)
TOC	Sediment	4 oz glass	28 days	Ice (4°C)
AVS-SEM	Sediment	4 oz glass	7 days**	Ice (4°C)
Grain size	Sediment	16 oz glass	6 months	Ice (4°C)
Atterburg Limits	Sediment	Inc.	NA	Ice (4°C)
Specific Gravity	Sediment	Inc.	NA	Ice (4°C)
Moisture Content/Bulk Density	Sediment	Inc.	NA	Ice (4°C)
Laboratory UU Triaxial Shear	Sediment	Undisturbed Core Section	NA	Ice (4°C)
Consolidation	Sediment	Undisturbed Core Section	NA	Ice (4°C)
Direct Shear	Sediment	Undisturbed Core Section	NA	Ice (4°C)
Dredge Elutriate Test	Sediment	1 liter	NA	Ice (4°C)
Modified Elutriate Test	Sediment	1 liter	NA	Ice (4°C)
Column Settling	Sediment	40 liters	NA	Ice (4°C)
SVOCs	Water	One 1-liter amber glass	7 days extraction/40 days analysis	Ice (4°C)
PCBs	Water	One 1-liter amber glass	7 days extraction/40 days analysis	Ice (4°C)
Pesticides	Water	One 1-liter amber glass	7 days extraction/40 days analysis	Ice (4°C)
RCRA Metals	Water	One 500-mL HDPE	6 months/28 days*	Ice (4°C), HNO_3 pH<2
DOC	Water	One 250-mL HDPE	28 days	Ice (4°C), H_2SO_4 pH<2
TOC	Water	One 250-mL HDPE	28 days	Ice (4°C), H_2SO_4 pH<2
TSS	Water	One 1-liter HDPE		Ice (4°C)
Bioassays	Sediment	1 liter	8 weeks	Ice (4°C)

* Holding time for mercury is 28 days. Holding time for the other RCRA metals is 6 months. ** Holding time not specified – assumed to be same as sulfides

Note: All holding times are from the date of sampling. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis without being qualified.

a cooler with ice to preserve them at 4°C and will be kept at this temperature at all times. All samples will be labeled and identified in accordance with Section 4.2.

Surface water samples will be assigned an individual sample identification number in the following manner:

FW-WB-##-WS-##

Where: FW = Foster Wheeler Environmental

WB-## = WBGCR Station ID (if applicable)

WS-## = Water Sample Number

Field blank samples (i.e., equipment rinsates) will be assigned an individual sample identification number in the following manner:

FW-WB-##-FB-##

Where: FW = Foster Wheeler Environmental

WB-## = WBGCR Station ID (if applicable)

FB-## = Field Blank Sample Number

Guidelines for water sample handling and storage are presented in Table 3-6. All samples will be placed immediately in a cooler with ice to preserve them at 4°C and will be kept at this temperature at all times. All samples will be labeled and identified in accordance with Section 4.2.

3.11.1 Core Processing

In this investigation, compositing will only be performed within individual locations to ensure that adequate sediment is available for the required analyses. Core sections not used for analysis will be managed in accordance with applicable requirements.

Core sections collected for chemical sampling will be extruded at the core processing station. Cores will be extruded by cutting the tube. This process produces a generally intact core for visual classification of the sediments with depth. Optionally, plastic core liners may be used during core collection. Plastic liners containing sediment are typically extracted from the core tube. The plastic liners containing the sediment core are then transported to the core processing station. Core sections that are to be archived will be archived in intervals based on stratigraphy.

Sediment composite samples will be processed according to the following step-by-step procedure:

1. Transfer sediment section from core to a clean stainless steel bowl and cover with aluminum foil.
2. Stir the composite sample until the sample is of uniform color and texture. If any material (e.g., shells, rocks) has to be removed from the sample, note it in the field logbook or on the sample description sheet.
3. Fill jars for physical, chemical, and biological analyses.
4. Seal each glass container in a plastic bag in case of breakage. Place in ice chest and pack samples to minimize the chances of breaking.
5. Decontaminate the equipment.
6. Collect excess sediment from the composite and dispose of as investigation derived waste, as discussed in Section 3.13.

3.12 EQUIPMENT DECONTAMINATION

Equipment decontamination will be performed using procedures outlined below and in Standard Operating Procedure (SOP) 1 and 2 in Appendix A.

Site personnel will perform decontamination of all equipment prior to removal from the site and between sample locations.

All non-disposable components of the sediment coring equipment, or other equipment used to collect sediment samples that contacts the sediments, will be decontaminated as follows:

- Potable water rinse
- Alconox/Liquinox detergent wash
- Potable water rinse
- Deionized (DI) water rinse
- Air dry

All sampling equipment that contacts the sediments will be decontaminated as follows:

- Potable water rinse
- Alconox detergent wash
- DI water rinse

If non-aqueous phase liquids are encountered in the sediments, the following extra steps may be included in decontaminating equipment:

- Potable water rinse
- Alconox detergent wash
- Methanol to remove water
- Hexane to remove nonaqueous phase liquid (NAPL) film
- DI water rinse

Rinsate blank samples will be collected as specified in the Quality Assurance Project Plan (QAPP) to document the level of decontamination.

All liquids generated as a result of decontamination processes will be containerized and handled as investigation derived wastes, as discussed in Section 3.13.

3.13 DISPOSAL OF INVESTIGATION-DERIVED WASTE

This plan for management and disposal of investigation-derived waste has been prepared in general accordance with the Waste Management Plan. The primary waste streams to be generated during this project and the proposed storage/disposal methods are provided in Table 3-7.

Table 3-7. Primary Waste Streams and Disposal Methods

Waste Stream	Estimated Quantity	Storage/Disposal Method
Excess/Rejected Sediment Samples	< 1000 lbs	Returned to river
Decontamination and Dewatering Wastewaters (except solvents)	<100 gallons	Returned to river
Personal Protective Equipment (PPE)/ Miscellaneous Debris	<40 cubic feet	Containerize/off-site disposal by FWENC
Decontamination Solvents (methanol and hexane)	<10 gallons	Containerize/off-site disposal by FWENC

3.13.1 Excess/Rejected Sediment Samples

Sediment samples that are rejected and/or determined to be in excess of what is required to conduct analytical sampling will be returned to the river in the area that it was collected.

3.13.2 Decontamination and Dewatering Wastewaters

Liquid wastes (i.e., dewatering water and decontamination waters) will be potentially contaminated with metals and PAHs. The presence of any hazardous constituents in the wastewaters is expected to be diluted; therefore, the wastewaters are not expected to be classified as hazardous waste. Therefore, the wastewaters are not likely to contain hazardous waste pursuant to the contained-in policy (i.e., environmental media that contain a listed hazardous waste are to be managed as a hazardous waste). Decontamination waters will be disposed of in the river.

In the use of solvents (e.g., methanol and hexane), decontamination activities will be conducted so as to minimize the potential for spills/releases of wastewaters. Spent decontamination solvents must be stored in leak-proof container(s) with secured lid(s). The lid is to remain closed except when the container is being used for decontamination activities. It is anticipated that liquid wastes be placed in 5-gallon buckets or similar containers for off-site disposal.

3.13.3 Personal Protective Equipment/Miscellaneous Debris

PPE and miscellaneous debris will be generated during sediment sampling activities. Interim storage of these materials in plastic bags is acceptable. The bags are to be disposed of at an appropriate solid waste facility dumpster after the completion of each sampling event.

3.14 SAMPLE DOCUMENTATION AND CHAIN OF CUSTODY

Environmental samples being analyzed at an off-site laboratory will be properly packaged and shipped for analysis. Chain-of-custody forms, sample labels, custody seals, and other sample documents will be completed as specified in the QAPP. Copies of the chain-of-custody forms will be retained with the project files.

The sample team or any individual performing a particular sampling activity is required to maintain a field logbook. These field logbooks will be bound and weatherproof, and contain entries of the investigation operations as the activities proceed.

4. PROJECT DOCUMENTATION, SAMPLING, AND REPORTING

Project field documentation, laboratory reporting, and the final report are discussed in this section.

4.1 PROJECT DOCUMENTATION

The primary types of documentation that will be used for this project include site logbook, photo logs, sample log forms, Field Change Request (FCR) forms, and sample tracking forms. The site logbooks are vital for documenting all on-site activities. Photo documentation will be used to provide an accurate account of the material sampled, sample locations, and environmental conditions. Sample log forms are used to summarize sampling data collected for various sample locations. The FCR forms are used to document any modifications made to the original project plans during field activities. Sample tracking forms include the chain of custody form, sample labels, and custody seals. The chain-of-custody form is used to track sample custody, which is an important aspect of field investigation activities that documents the proper handling and integrity of the samples. Sample labels are used to provide essential information and identification for all samples collected during field activities. Custody seals are used on all sample shipment containers to detect any tampering that may have occurred during transport or shipment. A description of each of these documentation methods is provided in the following sections. Detailed documentation protocol and procedures are provided in SOP 5 in Appendix A.

4.1.1 Field Logbooks

The field logbooks will be used to document all field sampling activities performed at the project site. The logbooks will contain the date, time, and description of all field activities performed; names of personnel; weather conditions; the names of visitors to the site; areas where photographs were taken; and any other data pertinent to the project. The site logbooks will also contain all sample collection and identification information and (if appropriate) a drawing of each area sampled, along with the exact location (coordinates) of where the sample was taken. The sampling information will be transferred to sample log forms when the sampler returns to the site office. The logbook is the official, legal record of site activities, and will serve as the key to sample designations and locations, and will include the date, time, site/sample location, sample identification number, sample matrix, how the sample was collected, any comments, and the sampler's name.

Each page of the field logbook will be numbered, dated, and signed by the author. The logbooks will be sturdy, weatherproof, and bound to prevent the removal of pages. All writing will be done in waterproof, black, permanent ink. No pages may be removed from the site logbooks for any reason. Blank pages, if any, will be marked "page intentionally left blank." Any mistakes will be crossed out with a single line, initialed, and dated. If multiple logbooks are used, they will be numbered sequentially.

4.1.2 Photo Documentation

Photographs will be taken at sampling locations and of each sample. These photos will help identify the location and will provide an accurate visual record of the material being sampled. All photographs taken will be identified in the field logbooks (preferably in a separate section of the book set aside for that purpose). Photographic logs will contain, at a minimum, the film roll number, the photo number, the date, the time, the initials of the photographer, and a description of the image in the photograph.

4.1.3 Sample Collection Information Form

Sampling logs and collection forms will be used to document site and sample characteristic data, which should agree with the information recorded in the site logbooks. Field personnel are required to fill out one sample log form for each sample collected. A copy of these forms will be stored in the field office or field files, with the original stored in the project file. A copy of these forms will also be included in the final data report and other documents, as appropriate. At a minimum, the log for each sample will contain the sample number, the date and time of sample collection, and a description of the sampling site, as well as the physical characteristics of the sample, the planned analysis, and the initials of the sampler.

4.1.4 Field Change Request Form

The FOL will be responsible for all environmental sampling activities, and will occasionally be required to adjust the field program, to accommodate site-specific needs after consultation with the PM and/or QA Coordinator. When it becomes necessary to modify a program or task, the changes will be documented on a FCR form. If a field change is later found to be unacceptable, the action taken during the period of deviation will be evaluated to determine the significance of any departure from the established program practices and appropriate action taken. All field changes will be numbered consecutively starting with the number 001.

4.1.5 Sample Tracking Forms

Sample tracking is an important aspect of field investigation activities, as it documents the proper handling and integrity of the samples. Sample tracking forms to be used for the project will include chain-of-custody forms, sample labels, custody seals, and sample summary logs.

4.1.6 Chain-of-Custody Form

The chain-of-custody form is used to document the history of each sample and its handling from its collection through all transfers of custody until it reaches the analytical laboratory. Internal laboratory records will document custody of the sample from the time it is received in the lab through its final disposition. The chain-of-custody form will be filled out after the samples have been collected and will be double-checked prior to the transport of the samples to the laboratory. At a minimum, the chain-of-custody form will contain the following information:

- Name of project
- Names of samplers
- Sample identification numbers
- Sampling date
- Sampling time
- Number and type of containers per sample
- Sample matrix
- Sample preservation, if any
- Analysis requested

The completed chain-of-custody form will be placed in a large capacity Ziploc® bag and secured to the sample transport container. If coolers are used to transport samples, the chain-of-custody form will be taped to the underside of the cooler lid.

4.2 SAMPLING

The following sections describe documentation with sampling and handling procedures. Details are outlined in SOP 3 in Appendix A.

4.2.1 Sample Labels

Sample containers will be clearly labeled with waterproof black ink at the time of sampling. Sample labels will contain the following information:

- Sample identification numbers
- Sample date
- Sample time
- Preservation used, if any
- Analysis requested
- Initials of samplers

The sample label will be attached to the sample container prior to, or just after, the container is filled and the lid secured. As an added measure of security, the finished label should be covered with clear packaging tape to protect the ink from moisture and to tightly secure the label to the sample container. Information on the sample label must match the information on the chain-of-custody form and in the site logbook for each sample.

4.2.2 Custody Seals

Custody seals will be used on sample shipping containers (coolers) that will either be shipped or sent by messenger to the laboratory. Custody seals will be attached to the lid and body of the coolers to detect any tampering during shipment. The custody seals will be signed and dated by the sampler or sample shipper. Custody seals are not required for samples delivered by hand directly to the lab unless left unattended.

4.2.3 Sample Summary Log

Sample summary logs will be maintained by the FOL and used to keep track of all phases of the sampling and analysis process for all individual samples. The summary sample logs will include sample collection dates, sample delivery dates, dates analytical results are received, laboratory sample delivery group, and laboratory work order number.

4.2.4 Sample Custody/Tracking Procedures

The samples collected must be traceable from the time they are collected until they or their derived data are used in the final report. In general, the following provisions apply to sample handling.

- The FOL, or sampler, will be responsible for the care and custody of the samples collected until they are properly transferred or dispatched to the laboratory.
- All appropriate documentation forms will be used, including sample labels, chain-of-custody forms, sample logs, and any other appropriate forms. Documentation will be completed neatly using waterproof, black ink.
- When transferring possession of samples, the individuals relinquishing and receiving them will sign, date, and note the time on the chain of custody form. Containers shipped by common carrier will have the chain-of-custody form enclosed in a watertight container (e.g., plastic resealable bag) and placed in the container prior to sealing.
- Samples will be packaged properly according to the current U.S. Department of Transportation requirements and promptly dispatched to the laboratory for analysis. Sample containers will be packed in coolers (or other shipping containers) with a low-density packing material, such as bubble wrap, and Blue Ice® or its equivalent. The coolers will be securely sealed.
- Each cooler will be accompanied by its own chain of custody form identifying its contents. A copy of the chain of custody form will be retained by the FOL for inclusion in project records.
- For coolers shipped via express delivery service, custody seals will be affixed to the outside of the coolers (shipping containers). The FOL, sampler, or shipper will sign and date the custody seals.

All samples will be shipped via express delivery for overnight delivery or hand delivered to the laboratory.

4.3 REPORTING

Reporting for this project includes laboratory reports, quality assurance reports, and the final report.

4.3.1 Laboratory Reports

Final written laboratory reports will be required for both chemical and physical analyses. Key elements of these reports are described below. It is expected that these reports, or summaries of these reports (as appropriate), will be appended to the final report.

4.3.2 Chemistry Reports

Final written laboratory reports and data deliverables will contain the following:

- Case narrative
- Identification of all protocols
- Summary results of initial and continuing calibrations
- Method and instrument blanks
- All field sample and field QA/QC sample results
- Surrogate recoveries (organic analyses)
- Matrix spikes (organics, batch specific)
- Matrix spike duplicates (organics only, batch specific)
- Supporting raw data and spectra
- Supporting sample tracking information (e.g. shipping forms, chain-of-custody forms)
- Supporting documentation on any corrective actions

Initial calibration information must include concentrations of each standard analyzed, response factors for each analyte at each standard concentration, relative standard deviation (RSD) (or correlation coefficient for metals analytes) over all standards for individual analytes. The RSD control limit range must also be indicated in the initial calibration summary data.

Continuing calibration information must include the response factor (organic analytes) for each analyte, and the calculated percent difference as compared to initial calibration (organic analytes). Control limits for each analyte must also be indicated on each continuing calibration summary data sheet.

Method blank and field sample data pages must indicate the method reporting limit and the dilution factor. Surrogate reporting forms must list control limits for surrogate recovery. Spike reporting forms (blank and matrix spikes) must indicate spike percent recovery and relative percent difference control limits (if spikes are analyzed in duplicate).

Documentation of detection limits (detection limit studies) and results of performance evaluation samples (supplied by regulatory agencies or purchased from certified vendors) are

not required for the data deliverable. However, these records must be supplied upon request. Total measurement error determination for field duplicate samples will be calculated.

Electronic data deliverables will also be required.

4.3.3 Geotechnical Testing and Contaminant Mobility Laboratory Report

Final written laboratory reports and data deliverables will include the following:

- A short write-up on laboratory methods, sample identifications, and problems encountered during testing
- A full data report of all chemistry data for elutriate testing
- Graphs and tables for the column settling test including total suspended solids (TSS) and turbidity versus time, interface height versus time, TSS versus turbidity, percent initial concentration (TSS versus time versus height), average TSS versus time, and initial test parameters with associated test description
- Grainsize data and Atterberg limits presented on graphs
- Specific Gravity in tabular format
- Direct shear will be represented as stress versus strain per load
- UU triaxial shear will be graphed as total stress versus strain with unit weight and index parameters tabulated below
- Consolidation will contain a summary plot and square root of time plots for each load
- A copy of the chain-of-custody forms

4.3.4 Quality Assurance Report

The project QA representative will prepare a quality assurance report based upon activities involved with the field sampling and review of the laboratory analytical data. Laboratory Data Consultants in Carlsbad, California will complete a data validation report. The laboratory quality assurance/quality control (QA/QC) reports and any data package validation reports will be incorporated into the QA Report by reference. This report will identify any field and laboratory activities that deviated from the approved sampling plan and the referenced protocols and will make a statement regarding the overall validity of the data collected. The QA/QC report will be incorporated into the final report.

4.3.5 Final Field Sampling Report

A final written report will be prepared documenting all activities associated with collection, compositing, transportation of samples, and chemical and physical analysis of samples. The chemical and physical laboratory reports (or appropriate summaries) will be included as appendices. At a minimum, the following will be included in the final report:

- Brief description of the project and its objectives
- Type of sampling equipment used
- Identification and description of protocols used during sampling and testing and an explanation of any deviations from the sampling plan protocols
- Description or summary of sampling and compositing procedures
- Descriptions of each sample and the sediments (i.e., core logs and sample logs)
- Summary of methods used to locate the sampling positions, and a discussion of the position accuracy
- Locations where the sediment samples were collected. Locations will be reported in NAD 83 State Plane Coordinates
- A plan view of the project showing the actual sampling locations
- Summary of all test results and data (hard copy and electronic)
- Final QA report (as an Appendix)
- Estimate of volume of sediment above native sand in marsh

In addition to the items listed above, the final report will include an electronic file of sample location information (i.e., sample ID, sample type, coordinates, sample data, water depth, and sample depth).

5. LABORATORY ANALYSIS

This section describes the laboratory procedures associated with physical and chemical testing applicable to this project in accordance with the Technical Specifications for the GCRRF Council (GCRRF 2001). Table 5-1 presents the analytes and other parameters, the analytical methods, and the target detection limits (TDLs) that are proposed for the evaluation of sediments in the WBGCR. All samples will be maintained according to the appropriate holding times and temperatures for each analysis. Quality control analyses are discussed in Section 5.2. Additional method and quality assurance information is described in the QAPP.

5.1 SEDIMENT CHEMISTRY

Sediment samples will be analyzed by STL for parameters listed in Table 5-1. Analytical methods are listed below for each with additional method and quality assurance information provided in Section 6 of the QAPP.

Table 5-1. Analytical Methodology and Target Detection Limits

Parameters	Analysis	Sediment Target Detection Limit[a]
Conventionals		
Grain Size	ASTM D-422-63	0.1 % retained
Total Organic Carbon	EPA SW 9060	500 mg/kg
Inorganic		
RCRA metals	SW846 6010B, 6020, 7471A	0.2 – 5 mg/kg
Oil and Grease	SW846 9071A	0.05 %
AVS-SEM	EPA Draft 1629	0.002 – 0.02 µ mole/g
Organics		
PCB Aroclors[b]	SW846 8082	60-160 µg/kg
PCB Congeners[c]	SW846 8082	1-20 µg/kg
Pesticides	SW846 8081A	8-80 µg/kg
Semivolatiles	SW846 8270C	330 µg/kg

(a) Detection limits are on wet weight basis. Detection limits on dry weight basis are dependent on total solids content.

(b) PCB Aroclors to be analyzed include 1016, 1221, 1232, 1242, 1248, 1254, 1260. Detected Aroclors will be summed to find total PCBs.

(c) PCB Congeners to be analyzed include 56 congeners.

Notes: Samples with high moisture contents or matrix interference may have detection limits higher than those listed.
ASTM = American Society for Testing and Materials.

EPA test methods are found in SW-846. Test methods for the evaluation of solid waste physical/chemical methods.

5.1.1 QA/QC Samples

QA/QC samples will be performed in accordance with the Technical Specifications (GCRRF 2001). At a minimum, the laboratory will comply with the QA/QC requirements shown in Table 5-2.

Table 5-2. Laboratory QA/QC Requirements

Analysis Type	Method Blanks[1]	Surrogates	Matrix Spike[1]	Duplicates[1,2]	CRM/SRM[3]/ LCS
Grain Size				X	
TOC	X		X	X	X
AVS-SEM	X		X	X	X
Oil and Grease	X		X	X	X
Metals	X		X	X	X
PAHs	X	X	X	X	X
Pesticides and PCBs	X	X	X	X	X

[1] 5 percent or one per batch, whichever is more frequent
[2] Matrix spike duplicate or laboratory sample duplicate will be run
[3] Reference material provided by laboratory
Note: CRM = Certified Reference Material
SRM = Standard Reference Material
LCS = Laboratory Control Sample

5.2 GEOTECHNICAL TESTING

A suite of physical tests are used to evaluate dredging and capping methods, dredged material transport and placement, dredge material behavior in the disposal site, potential short-term impacts at the dredge and disposal sites, and capacity of existing sediments to provide foundation support for capping material. The following tests will be completed for selected samples collected in the cores (Table 5-3).

Table 5-3. Geotechnical Methodology and Target Detection Limits (if applicable)

Parameters	Method	Sediment Target Detection Limit
Grain Size	ASTM D 422-63 with Hydrometer	0.1% retained
Atterburg Limits	ASTM D 4318-95	NA
Specific Gravity	ASTM D 854-92	NA
Moisture Content/Bulk Density	ASTM D 2216	NA
Direct Shear	ASTM D 3080	NA
Laboratory UU Triaxial Shear	ASTM D 2850-95 with modifications in USEPA/USACE 1998	NA
Consolidation	ASTM D 2435-90	NA
Column Settling	USEPA/USACE 1998	NA
Dredge Elutriate Test	DiGiano et al. 1995	NA
Modified Elutriate Test	USEPA/USACE 1998	NA

ASTM = American Society for Testing and Materials
UU = unconsolidated, undrained

5.2.1 Grain Size

Grain size will be analyzed by the hydrometer and sieve method following ASTM Method D-422-63 and will provide information on site geologic character and engineering properties of sediment proposed for remediation.

5.2.2 Atterberg Limits

Atterberg Limit analysis will be analyzed on selected samples of fine-grained sediment in accordance with ASTM D-4318-95 (includes organic determination). Atterberg limits, which include the liquid limit, plastic limit, and the plasticity index, are used to define plasticity characteristics of clays and other cohesive sediments.

5.2.3 Specific Gravity

Specific gravity will be measured on selected samples analyzed for engineering properties in accordance with ASTM D-854-92. The specific gravity of sediment samples is used to determine sediment dredgeability, the dispersal and settling characteristics of the dredged material after placement, and the bed consolidation after capping.

5.2.4 Moisture Content and Bulk Density

Moisture content and bulk density will be measured on selected samples analyzed for engineering properties in accordance with ASTM D-2216. Moisture content is used to determine the initial in-situ void ratio of the sediment and to estimate the short-term bulking (or increase in volume) during dredging activities.

5.2.5 Shear Testing

Laboratory shear tests will be performed on representative river sediments to evaluate the foundation capacity of the sediments (Holtz and Kovacs, 1981). The laboratory shear testing is used to evaluate foundation capacity of a cap and for dredge equipment selection and production rates. One critical loading will be in the short term, immediately following cap placement. Seismic loading is also a short-term condition. The appropriate shear test to model this condition is the unconsolidated, undrained (UU) triaxial test of shear strength.

Laboratory shear testing will be completed on undisturbed cores collected from seven coring locations. The undisturbed samples will be collected from the surface and at a depth of approximately 5 feet below mudline from each location using a vibracorer sampler. The

samples will be capped, sealed, taped and delivered to the physical testing laboratory for analysis.

Direct shear will be completed on undisturbed cores collected from seven coring locations. The undisturbed samples will collected from locations containing higher sand content. The samples will be capped, sealed, taped and delivered to the physical testing laboratory for analysis.

5.2.6 Consolidation Testing

A traditional consolidation test will be run on representative cores in the river in accordance with ASTM D-2435-90, to determine if these materials will consolidate under potential loading. The core samples will be collected and delivered to the testing laboratory intact ("undisturbed").

Consolidation testing will be completed on undisturbed cores collected from 14 coring locations (the same locations as for shear testing). The undisturbed samples will be collected from the surface and at a depth of approximately 5 feet below mudline from each location using a vibracorer. The samples will be capped, taped, sealed, and delivered to the physical testing laboratory for analysis. The same cores can be analyzed for both consolidation and laboratory shear testing.

5.2.6.1 Column Settling Test

The column settling test is used to model the settling behavior of sediments (USEPA/USACE 1998). The objective is to predict the gravity settling rate and behavior of dredged material discharged as a slurry of water and sediment into a Confined Disposal Facility (CDF). Results of the testing identify the characteristics of the sediment settling and consolidation which are used to select an appropriate placement method, predict potential water quality effects in or near the release point of the slurry water from the CDF, and to design the disposal site area and volume capacity. A representative portion of the composite sediment described above will be used for the column settling test. Approximately 40 liters of sediment representing each composite sample and 60 liters of water from the WBGCR are required for the test. Site water will be collected as described above.

5.3 CONTAMINANT MOBILITY TESTING

Mobility and dredgeability testing will be performed on representative dredge material to provide an assessment of contaminant mobility during dredging and placement operations

(Table 5-4). The dredging elutriate test (DRET) and modified elutriate test (MET) are used to predict the potential short-term contaminant release at the point of dredging and at the point of disposal. The MET is used to predict the quality of effluent from the filling of an upland or nearshore confined disposal facility or de-watering facility using hydraulic dredging. This data may be required for final design if a temporary stockpile, or other dredged material confinement is required during transfer to final disposal, or for a confined disposal alternative. The DRET method is particularly effective for examining the short-term impacts at the point of dredging. This test will be required for point of dredging assessment. The tests are generally conducted in accordance with WES-recommended procedures (USEPA/USACE, 1998; DiGiano, et al., 1995).

Table 5-4. Analytical Methodology and Target Detection Limits for Contaminant Mobility Testing

Parameters	Analysis	Water Target Detection Limit
Conventionals		
TOC/DOC	EPA 415.1	0.5 mg/L
Total Suspended Solids	EPA 160.2	5 mg/L
RCRA Metals[a]		
Arsenic	EPA 200.10/200.12/200.13	50 µg/L
Barium	EPA 200.10/200.12/200.13	50 µg/L
Cadmium	EPA 200.10/200.12/200.13	1 µg/L
Chromium	EPA 200.10/200.12/200.13	5 µg/L
Lead	EPA 200.10/200.12/200.13	1 µg/L
Mercury	EPA 200.10/200.12/200.13	0.5 µg/L
Selenium	EPA 200.10/200.12/200.13	2 µg/L
Silver	EPA 200.10/200.12/200.13	1 µg/L
Zinc	EPA 200.10/200.12/200.13	50 µg/L
Organics		
PCB Aroclors[b]	SW846 8082	0.010 µg/L
Chlorinated Pesticides	SW846 8081	0.001 µg/L for DDT and derivatives[c]
Semivolatiles	SW846 8270	10 µg/L

(a) RCRA = As, Ba, Cd, Cr, Pb, Hg, Se, Ag
(b) PCB Aroclors to be analyzed include 1016, 1221, 1232, 1242, 1248, 1254, 1260. Detected Aroclors will be summed to find total PCBs.
(c) Chlordane = 0.004 µg/L, toxaphene = 0.0002 µg/L, endrin = 0.030 µg/L, heptachlor/heptachlor epoxide = 0.003 µg/L, and all others 0.050 µg/L or less. (Foster Wheeler Environmental 2002c)
EPA test methods are found in SW-846. Test methods for the evaluation of solid waste physical/chemical methods.

Representative sediment from areas yet undetermined for dredging in the river will be collected for elutriate testing. Approximately 4 liters of sediment representative of the dredge prism are required for each of the two tests. In addition, approximately 10 to 15 liters of site water will be collected from the waterway for the testing.

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ADDENDUM 1

FIELD SAMPLING AND ANALYSIS PLAN

WEST BRANCH
GRAND CALUMET RIVER BASIN
EAST CHICAGO, INDIANA

ADDENDUM 1

FIELD SAMPLING AND ANALYSIS PLAN

October 2002
Revision 0

Prepared by

FOSTER WHEELER

FOSTER WHEELER ENVIRONMENTAL CORPORATION

12100 NE 195th Street
Bothell, Washington
(425) 482-7600
(425) 482-7652 (Fax)

Prepared for

U.S. Fish and Wildlife Service
Bloomington Field Office
620 South Walker Street
Bloomington, Indiana 47403

Under Contract to

United States Fish and Wildlife Service
Environmental and Facility Compliance Branch
P.O. Box 25207
7333 W. Jefferson Avenue, Suite 375
Denver, Colorado 80225-0207

Contract No.: FWS 1448-98695-98-C008
Task Order No. 02-Y037

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1. INTRODUCTION

This Addendum to the Field Sampling and Analysis Plan (FSAP) has been prepared by Foster Wheeler Environmental Corporation (Foster Wheeler Environmental) at the request and direction of the U.S. Fish and Wildlife Service (USFWS) Environmental and Facility Compliance Office and the Bloomington Indiana Field Office. The USFWS is acting as the contracting agency on behalf of the Grand Calumet River Restoration Fund (GCRRF) Council, which is composed of USFWS, Indiana Department of Environmental Management (IDEM), U.S. Environmental Protection Agency (EPA), and Indiana Department of Natural Resources (IDNR).

This Addendum to the FSAP summarizes additional sampling for the Phase 2 field and laboratory tasks necessary to complete a sediment characterization and bathymetry investigation for the WBGCR. The objective of this effort is to further characterize surficial and deeper historical sediments within portions of the river that were not included in the FSAP. Upon completion, the Phase 2 tasks will be used by Foster Wheeler Environmental to prepare a Restoration Alternatives Development and Evaluation Report on the WBGCR.

2. SAMPLING AND ANALYSIS

The proposed field and laboratory methodology and contaminants of concern for the additional sediment samples discussed in this addendum are the same as those referenced in the FSAP.

2.1 SAMPLING LOCATIONS AND DEPTHS

Sediment sampling is proposed at nine additional locations in three different transects as shown in Figures 2-1, 2-6, and 2-12, and summarized in Table 2-1. Sample locations are distributed along transects within three river reaches (Reach 1, 2, and 7).

Table 2-1. Proposed Phase 2 Station Locations Added

Station Number	Northing	Easting
WB-43	2319215	2843914
WB-44	2319191	2843899
WB-45	2319167	2843883
WB-46	2320507	2839314
WB-47	2320476	2839296
WB-48	2320444	2839279
WB-49	2323501	2831742
WB-50	2323492	2831741
WB-51	2323483	2831740

Initial sample locations may be modified in the field based on site-specific conditions (e.g., to avoid an underground utility). Approximate sample locations proposed for Phase 2 as listed in the FSAP as well as historical sampling locations are also included on Figures 2-1, 2-6, and 2-12. These figures correspond to the same figure numbers in the FSAP for referencing the same sampling area.

Sediment sampling will be performed at a new total of 51 stations to determine the depth of sediments that may require remediation. Core depth is expected to range from 8 feet to a maximum of approximately 12 feet, or refusal. The primary objective of the subsurface sediment samples is to determine the vertical extent of sediment requiring remediation. Each subsurface core will be logged in the field using the visual-manual classification methods of American Society for Testing and Materials (ASTM) D 2488. Sediment sample intervals will be collected for analysis of parameters listed in Table 3-1 of the FSAP.

Sample intervals will generally correspond to sediment stratigraphy (e.g., if a major sediment layer occurs from 0 to 8 feet, the likely sample interval will be 0 feet to 4 feet and 4 feet to 8 feet). The last core interval should be native material in order to determine the depth of clean sediment. A minimum of two, and not more than four, composited samples will be taken from each sample location. If multiple sediment strata are encountered, additional sediment intervals will be collected and archived for future analysis, if needed.

Table 2-2 lists the number of samples collected at the additional sample locations. The number of QC samples will be determined by the sum of all the samples to be analyzed in the FSAP and this Addendum.

2.2 BIOASSAY TESTING

Sufficient sample volume (i.e., 1 liter) of selected composite samples will be collected and sent to U.S. Geological Society Biological Research Division in Columbia, Missouri for sediment toxicity testing. A 28-day survival and growth test using *Hyalella azteca* will be performed. Bioassay samples will be collected from a total of 51 sampling locations listed in the FSAP and Addendum.

2.3 SEDIMENT SAMPLE COLLECTION METHODS

Subsurface sampling will be performed using a vibracore coring system as the primary sample collection system. Methods used for collection of the sample, processing, and recording are described in the FSAP.

2.4 FINAL FIELD SAMPLING REPORT

A final written report will be prepared documenting all activities associated with collection, compositing, transportation of samples, and chemical and physical analysis of samples listed in the FSAP and Addendum as described in the FSAP.

NOT FOR CONSTRUCTION

DRAWING REDUCED HALFSIZE

NOTES:

1. AERIAL PHOTOGRAPHY WAS TAKEN BY MERRICK & CO. ON 3/24/95.
2. EXISTING TOPOGRAPHIC DATA IS BASED ON MERRICK & CO. SURVEY (1996).
3. EXISTING SURVEY IS BASED ON INDIANA STATE PLANE NAD83.
4. HISTORICAL SAMPLING STATION LOCATIONS ARE APPROXIMATE.
5. PROPOSED SAMPLING LOCATIONS ARE BASED ON INDIANA STATE PLANE, WEST ZONE, NAD 83.

LEGEND:

● HISTORICAL SAMPLING STATION

□ PROPOSED SAMPLING STATION

STATION	NORTHING	EASTING
WB-1	2319767.98	2843581.40
WB-2	2319756.35	2843545.15
WB-3	2319744.72	2843508.89
WB-43	2319214.86	2843913.92
WB-44	2319191.17	2843898.59
WB-45	2319167.47	843883.26

N

25 0 25 50 75
(Scale in Feet)
HORIZONTAL SCALE

WEST BRANCH OF THE GRAND CALUMET RIVER
FIGURE 2-1
SAMPLE STATION LOCATIONS
(REACH 1)

FOSTER WHEELER ENVIRONMENTAL CORPORATION

DESIGNED: –	APPROVED	
DRAWN: AEC		DATE: 9/20/02
CHECKED: –		
SCALE: AS NOTED	DRAWING NO. MGCABM01	1/12

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NOTES:

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2. EXISTING TOPOGRAPHIC DATA IS BASED ON MERRICK & CO. SURVEY (1996).
3. EXISTING SURVEY IS BASED ON INDIANA STATE PLANE NAD83.
4. HISTORICAL SAMPLING STATION LOCATIONS ARE APPROXIMATE.
5. PROPOSED SAMPLING LOCATIONS ARE BASED ON INDIANA STATE PLANE, WEST ZONE, NAD 83.

LEGEND:

● HISTORICAL SAMPLING STATION

□ PROPOSED SAMPLING STATION

STATION	NORTHING	EASTING
WB-46	2320507.28	2839313.53
WB-47	2320475.55	2839296.06
WB-48	2320443.81	2839278.59

N

25 0 25 50 75
(Scale in Feet)
HORIZONTAL SCALE

WEST BRANCH OF THE GRAND CALUMET RIVER
FIGURE 2-6
SAMPLE STATION LOCATIONS
(REACH 2 AND 3)

FOSTER WHEELER ENVIRONMENTAL CORPORATION

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SCALE: AS NOTED	DRAWING NO. MGCABM01	6/12

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1. AERIAL PHOTOGRAPHY WAS TAKEN BY MERRICK & CO. ON 3/24/95.
2. EXISTING TOPOGRAPHIC DATA IS BASED ON MERRICK & CO. SURVEY (1996).
3. EXISTING SURVEY IS BASED ON INDIANA STATE PLANE NAD83.
4. HISTORICAL SAMPLING STATION LOCATIONS ARE APPROXIMATE.
5. PROPOSED SAMPLING LOCATIONS ARE BASED ON INDIANA STATE PLANE, WEST ZONE, NAD 83.

LEGEND:

HISTORICAL SAMPLING STATION

PROPOSED SAMPLING STATION

STATION	NORTHING	EASTING
WB-37	2323284.45	2832975.49
WB-38	2323269.86	2832975.80
WB-39	2323255.27	2832976.10
WB-40	2323434.93	2832088.37
WB-41	2323424.26	2832086.96
WB-42	2323413.60	2832085.54
WB-49	2323500.99	2831742.33
WB-50	2323491.95	2831740.98
WB-51	2323482.91	2831739.63

N

25 0 25 50 75
(Scale in Feet)
HORIZONTAL SCALE

WEST BRANCH OF THE GRAND CALUMET RIVER
FIGURE 2-12
SAMPLE STATION LOCATIONS
(REACH 7)

FOSTER WHEELER ENVIRONMENTAL CORPORATION

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SCALE: AS NOTED	DRAWING NO MGCABM01	12/12

Table 2-2. Sampling and Analysis Summary for Additional Samples from the WBGCR

Sample Matrix	Laboratory Analysis	No. of Samples*	Field QA Samples		Lab QA Samples	Total
			Environmental Duplicates	Equipment (Rinsate) Blanks	MS/MSD Samples	
Sediment						
	Semivolatile Organics	18	1	1	1/1	22
	Chlorinated Pesticides	18	1	1	1/1	22
	PCBs	18	1	1	1/1	22
	RCRA Metals	18	1	1	1/1	22
	Oil and Grease	18	1	1	1/1	22
	TOC	18	1	1	1/1	22
	AVS-SEM	18	1	1	1/1	22

* Estimated number of samples. Actual number will change during field activities. Additional subsurface sediment samples may be archived. The number of environmental duplicates and MS/MSD samples will be dependent on the number of field samples collected, and shall be analyzed at a rate of 5 percent (1 per 20).

3. LABORATORY ANALYSIS

The laboratory procedures associated with physical and chemical testing applicable to this project in accordance with the Technical Specifications for the GCRRF Council (GCRRF 2001) as described in the FSAP. Methods and procedures for the additional samples will be identical to those methods and procedures used for samples listed in the FSAP. Additional method and quality assurance information is described in the QAPP and applies to all samples.

4. REFERENCES

Foster Wheeler Environmental. 2002. Field Sampling and Analysis Plan, West Branch of the Grand Calumet River. Prepared for the U.S. Fish and Wildlife Service by Foster Wheeler Environmental Corporation, Bothell, Washington. October 2002.

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APPENDIX A
STANDARD OPERATING PROCEDURES

SOP 1: Sampling Equipment Decontamination

SOP 2: Decontamination of Hand Sampling Equipment

SOP 3: Sample Packing and Shipment

SOP 4: Vibracore Sampling

SOP 5: Documentation

SOP 6: Bathymetry Survey (WB)

CATEGORY: Standard Operating Procedure	TITLE: Sampling Equipment Decontamination	NO.: SOP 1 Date: 10/29/99

STANDARD OPERATING PROCEDURE 1
SAMPLING EQUIPMENT DECONTAMINATION

Required Equipment

- Source-approved potable tap water
- ASTM Type II, or equivalent, reagent deionized (DI) water
- Laboratory-grade detergent (i.e., Alconox® or equivalent)
- 5-gallon buckets
- Scrub brushes
- Plastic garbage can
- Plastic sheeting
- Sprayers (i.e., garden or hand)
- Pressure washer (provided by subcontractors).

Typical Procedures

Preparation:

1. Set up decontamination area on plastic sheeting.
2. Set up "clean" area upwind of decontamination area for air drying of equipment.
3. Fill one 5-gallon "wash" bucket with detergent and potable tap water.
4. Fill spray bottles with DI water and methanol.

Decontamination of Sampling Equipment:

1. Clean all sampling equipment to remove gross contamination.
2. Wash equipment in detergent.
3. Rinse with potable tap water (bucket).
4. Rinse with DI water (sprayer).
5. Air dry.
6. Place disposable items (sampling gloves, paper towels, etc.) in garbage can.
7. Document activities in the field and site logbooks.

Note: In adverse weather conditions, air drying may not be possible. In this case, a methanol rinse will be added.

CATEGORY: Standard Operating Procedure	TITLE: Decontamination of Hand Sampling Equipment	NO.: SOP 2 Date: 10/29/99

STANDARD OPERATING PROCEDURE 2
DECONTAMINATION OF HAND SAMPLING EQUIPMENT

Required Equipment

- Source approved potable tap water
- ASTM Type II, or equivalent, reagent deionized (DI) water
- Laboratory-grade detergent (i.e., Liquinox, Alconox, or equivalent)
- 5-gallon buckets
- Scrub brushes
- Plastic sheeting
- Garden and hand sprayers (plastic).

Typical Procedures

Preparation:

- Set up decontamination area—buckets, plastic sheeting, scrub brushes, sprayers.
- Set up "clean" area upwind of decontamination area for air drying of equipment.
- Fill one 5-gallon bucket with detergent and potable tap water.
- Fill a second 5-gallon bucket with potable tap water only.
- Fill new/clean spray bottles with DI water (garden sprayer).

Decontamination of Sampling Equipment:

- Scrub all sampling equipment to remove gross contamination.
- Wash equipment in detergent.
- Rinse with potable tap water.
- Rinse with DI water.

Note: If sticky or oily residues are observed during sampling, an acid/solvent rinse sequence (i.e., nitric acid [0.1 percent] and isopropanol) will be added prior to the final DI water rinse.

CATEGORY: Standard Operating Procedure	TITLE: Decontamination of Hand Sampling Equipment	NO.: SOP 2 Date: 10/29/99

- Air dry.
- Cover sampling surfaces with aluminum foil.
- Place disposable items (sampling gloves, paper towels, etc.) in garbage can, garbage bag, or 5-gallon bucket with lid.
- Document activities in the field and site logbooks.

Note: All decontamination fluids will be contained in a tub or bucket for proper disposal.

CATEGORY: Standard Operating Procedure	TITLE: Sample Packing and Shipment	NO.: SOP 3 Date: 10/29/99

STANDARD OPERATING PROCEDURE 3
SAMPLE PACKING AND SHIPMENT

Required Equipment

- Sampling and Analysis Plan
- Indelible, black ink pens
- Field logbook
- Ziploc® bags
- Coolers
- Blue Ice®
- Strapping tape or duct tape
- Vermiculite
- Sample logs
- Sample labels
- Chain of custody forms
- Custody seals.

Typical Procedures

Before packing, all samples will be individually labeled and noted in the field logbook by the Sample Coordinator or designee. Labels will be completed with all required information. The samples will be assigned individual numbers. The sample numbers will be used to complete the chain of custody forms.

CATEGORY: Standard Operating Procedure	TITLE: Sample Packing and Shipment	NO.: SOP 3 Date: 10/29/99

Samples to be hand-delivered to the laboratory:

1. Attach sampling label and custody seals (if necessary) on each sample jar.
2. Place each sample in a plastic Ziploc® bag and align the label so it can be easily read. Seal the bag.
3. Place individual samples into the cooler so that each container is safely secured.
4. Include sufficient ice or Blue Ice® packs to cool samples to 4°C.
5. Complete a chain of custody form for the containers and seal in a Ziploc® bag. Place the chain of custody form in the cooler. Always transport the cooler together with its accompanying chain of custody form.

Samples to be shipped to the laboratory:

1. Attach custody seal on each sample jar.
2. Place each sample in a plastic Ziploc® bag and align the label so it can be easily read. Seal the bag.
3. Spread a layer of vermiculite or foam peanuts at least 1-inch deep in the bottom of a cooler.
4. Place individual samples into the cooler so each container has at least 1 inch of clearance on all sides.
5. Fill the void spaces with vermiculite, foam peanuts, or other cushioning material. When the level of the cushioning material is even with the jar tops, jiggle the cooler vigorously to settle the cushioning material, then add enough additional material to cover the containers with at least 2 inches.
6. Cover the head space inside the cooler with frozen Blue Ice® packs and cover with more packing material.
7. Place the chain of custody form in a sealed Ziploc® bag and attach to inside cover of the cooler.
8. Close and latch the cooler. Wrap the cooler and lid with at least two turns of strapping or duct tape. Affix signed custody seals over the edge of the lid and the top of the cooler body at front and rear.
9. Label coolers with up arrows and information to comply with U.S. Department of Transportation requirements.

The Lead Sampler will notify the laboratory approximately when and how many samples will arrive. The samples must be kept refrigerated (or packed with Blue Ice®) between

sampling and analysis processing. The sample containers will be checked on arrival at the laboratory for breakage.

CATEGORY: Standard Operating Procedure	TITLE: Vibracore Sampling	NO.: SOP 4 Date: 10/29/99

STANDARD OPERATING PROCEDURE 4
VIBRACORE SAMPLING

Required Equipment

- Sampling and Analysis Plan (SAP), Site logbook, Sample logs, Sample labels
- Indelible black ink pens
- Camera
- End caps for Vibracore sleeves
- Electrical tape, duct tape, aluminum foil
- Vibracore apparatus
- Sample shipping containers
- Ice
- H_2S monitor
- Tape measure

Operating Procedures

1. The support frame is maneuvered over the approximate position for the core and the water depth and bottom slope determined. The Vibracore Sampler (VCS) base will be adjusted to the bottom slope, if required.

2. The corer is suspended from the support frame and lowered to the bottom.

3. After successful deployment, the penetration recording system and vibratory head are engaged and the desired penetration is obtained. Penetration versus time is recorded.

4. The core is extracted from the sediment and the VCS is recovered and stowed.

5. The core, with contained sediment, is removed from the driving head and transferred to a processing rack. (Note: Check H_2S in the work space prior to proceeding)

6. Core Measuring: The distance from the top of the core to the end of the core tube is physically measured and the top of the core is marked on the outside of the tube using black indelible ink (large Sharpie®, etc.).

7. The tube is positioned in the rack to allow cutting at/near the top of the core and the tube is securely clamped to the rack.

8. The excess core tube is cut off using a tube cutter. Two personnel are required—one to operate the tube cutter and a second to hold onto the segment being removed.

9. The core is marked for cutting into desired segments, positioned in the core rack, and cut. As segments are removed, they are sealed, labeled, and stowed in a core storage box. This box is insulated and can be covered if segment length is less than 4 feet. Ice may be used for cooling.

10. The core holding area is then washed down using the deck pump/hose system.

11. Equipment is secured and the support frame is moved to the next sampling site.

Core Acceptance Criteria

- A continuous core sample will be collected to the designated coring depth or until refusal.
- The depth of core penetration will be measured and recorded.
- The core sample will be evaluated at the visible ends of the core tube to ensure that retrieved sediment core reached the required penetration depth. Sample recovery will be inspected relative to the following acceptance criteria:

1. Overlying water is present and the surface is intact;

2. Calculated compaction is not greater than 25 percent; and

3. The core tube appears intact without obstruction or blocking.

CATEGORY: Standard Operating Procedure	TITLE: Documentation	NO.: SOP 5 Date: 10/29/99

STANDARD OPERATING PROCEDURE 5
DOCUMENTATION

Required Equipment

- Sampling and Analysis Plan
- Indelible black-ink pens
- Site logbook (bound and ruled)
- Camera

Typical Procedures

Photo Documentation:

1. Record sample location in site logbook.
2. Obtain a sufficient amount of photographs of all material before sampling to ensure accurate documentation of the site and sampled materials

Site Logbook:

Note: One site logbook will be used for all tasks. The sampling coordinator is responsible for documenting all site activities.

1. Label front cover of site logbook in indelible black ink with project name and number, client name, contact number, and start and end dates of field investigation. If multiple logbooks are used, they must be numbered sequentially.
2. Enter the date and page number on the top of each page.
3. Enter the day; date; time of arrival on site; weather conditions; and names, titles, and organizations of personnel present on site.
4. List instrument calibration information including serial number, model number, calibration fluid, readings, adjustments, red line (if applicable), battery level, and person performing the calibration.
5. Record name, title, and organization of all visitors to the site.
6. Describe all site activities performed for each day.
7. Describe any field tests that were performed.
8. Describe any samples collected, their sample numbers, and whether splits, duplicates, or blanks were prepared.

CATEGORY: Standard Operating Procedure	TITLE: Documentation	NO.: SOP 5 Date: 10/29/99

9. List all chain of custody details, including air bills, sample identification numbers, and analytical laboratory.
10. If applicable, list any equipment failures encountered during the day, and how repairs were made.
11. Describe any field changes that occur which deviate from the Sampling and Analysis Plan.
12. Record all telephone calls relating to the field activities.
13. The sampling coordinator or designee must sign the bottom of each page.
14. Label front cover of site logbook in indelible black ink with project name and number, client name, contact number, and start and end dates of field investigation. If multiple logbooks are used, they must be numbered sequentially.
15. Enter the date and page number on the top of each page.
16. Enter the day; date; time of arrival on site; weather conditions; and names, titles, and organizations of personnel present on site.
17. List instrument calibration information including serial number, model number, calibration fluid, readings, adjustments, red line (if applicable), battery level, and person performing the calibration.
18. Record name, title, and organization of all visitors to the site.
19. Describe all site activities performed for each day.
20. Describe any field tests that were performed.
21. Describe any samples collected, their sample numbers, and whether splits, duplicates, or blanks were prepared.
22. List all chain of custody details, including air bills, sample identification numbers, and analytical laboratory.
23. If applicable, list any equipment failures encountered during the day, and how repairs were made.
24. Describe any field changes that occur which deviate from the Sampling and Analysis Plan.
25. Record all telephone calls relating to the field activities.
26. The sampling coordinator or designee must sign the bottom of each page.

CATEGORY: Standard Operating Procedure	TITLE: Bathymetry Survey – Small Vessel Operations	NO.: SOP 6 Date: 09/16/02

Work Vessel:

The work vessel should be chosen based upon the conditions existing at the time of the survey. It should be either a small, flat-bottomed boat or an inflatable raft. It should be capable of holding two people and any required sampling and health and safety equipment. It should be rated for at least a ten horsepower motor although this may not be necessary for an inflatable raft. Provisions should be made to allow for protection of electronic equipment and power supplies from adverse weather.

Procedures:

1. Survey locations should be laid out prior to mobilization and entered into the navigation system. Depths should be measured along cross-sections spaced 100 feet apart. Cross section spacing may be adjusted in the field based on conditions at the time of the survey such as accessibility, safety, and river flow. Line spacing shall not exceed 250 feet. In addition to the planned lines, cross-sections should be surveyed at significant features such as bridges and culverts.

2. In open areas where GPS positioning is reliable and boat access is available, depths should be measured using an acoustic fathometer and GPS unit capable of receiving differential corrections in real time and providing location coordinates to an accuracy of 2.0 meters.

3. At the beginning of each day the GPS is used, its accuracy should be verified by comparing the position reported by the GPS unit to a position of known accuracy. Any discrepancy greater than 2.0 meters between the reported and actual positions should be resolved prior to surveying. At the beginning and end of each day the fathometer is used, it should be calibrated according to the manufacturers instructions.

4. In areas where water depths are 2 feet or less, or GPS is unreliable, an inflatable boat and manual depth measurement may be used to measure depths. If the river is too shallow for an inflatable raft, or if vegetation restricts raft accessibility, measurement locations may reached by wading.

5. On cross sections where GPS is not used for navigation, manual depth measurements should be made at the desired cross section at intervals between 5 and 25 feet based upon the variability of the river bottom.

6. Manual depth measurements may be made by either a lead line, composed of an 8-pound mushroom anchor with a 6-inch diameter crown attached to a survey tape measure or a survey control rod with a 6-inch diameter plate attached to its base. The information recorded for each measurement should be, at a minimum, cross section identifier, depth, time, and position on the cross section.

7. Whenever depth is being measured, the water surface elevation should be monitored. This may be accomplished by means of a staff gauge, a tide gauge, or similar equipment. Data from the tide gauge should be referenced to the local vertical datum.

APPENDIX B

FIELD DOCUMENTATION FORMS

FOSTER WHEELER ENVIRONMENTAL CORPORATION
CHAIN OF CUSTODY RECORD

PROJECT					NO. CONTAINERS											REMARKS OR SAMPLE LOCATION	PRESERVATION	
SAMPLERS: (Signature)																	ICED	SPECIFY CHEMICALS ADDED AND FINAL pH IF KNOWN
SAMPLE NUMBER	DATE	TIME	COMP.	GRAB														

Relinquished by: (Signature) (1)	Date / Time	Received by: (Signature)	Relinquished by: (Signature) (4)	Date / Time	Shipped via:
Relinquished by: (Signature) (2)	Date / Time	Received by: (Signature)	Received for Laboratory by: (Signature)	Date / Time	Shipped via:
Relinquished by: (Signature) (3)	Date / Time	Received by: (Signature)	Remarks		

SEDIMENT SAMPLE COLLECTION FORM

Sample No.

Project Name:
Project No.:

Sampling Data

Date: Time: Sampled by: Checked by:

Equipment: Single Van Veen (.1m^2) Double Van Veen (.2m^2) Small Van Veen (.025m^2) Petite ponar

Location Description:

Deployment No: Time: Northing: Easting:
Bio/Chem: Bottom Depth Penetration Depth RPD Depth
Sediment Type: Cobble Gravel Sand C M F Silt Clay
Large Fauna: Starfish Worms Clams Crabs
Sediment Colors: Gray Black Light Brown Dark Brown
Sediment Odor: H_2S Petroleum None Slight Moderate Strong Overwhelming
Photo Log: Roll No. Photo No.
Comments:

Deployment No: Time: Northing: Easting:
Bio/Chem: Bottom Depth Penetration Depth RPD Depth
Sediment Type: Cobble Gravel Sand C M F Silt Clay
Large Fauna: Starfish Worms Clams Crabs
Sediment Colors: Gray Black Light Brown Dark Brown
Sediment Odor: H_2S Petroleum None Slight Moderate Strong Overwhelming
Photo Log: Roll No. Photo No.
Comments:

Deployment No: Time: Northing: Easting:
Bio/Chem: Bottom Depth Penetration Depth RPD Depth
Sediment Type: Cobble Gravel Sand C M F Silt Clay
Large Fauna: Starfish Worms Clams Crabs
Sediment Colors: Gray Black Light Brown Dark Brown
Sediment Odor: H_2S Petroleum None Slight Moderate Strong Overwhelming
Photo Log: Roll No. Photo No.
Comments:

Deployment No: Time: Northing: Easting:
Bio/Chem: Bottom Depth Penetration Depth RPD Depth
Sediment Type: Cobble Gravel Sand C M F Silt Clay
Large Fauna: Starfish Worms Clams Crabs
Sediment Colors: Gray Black Light Brown Dark Brown
Sediment Odor: H_2S Petroleum None Slight Moderate Strong Overwhelming
Photo Log: Roll No. Photo No.
Comments:

Deployment No: Time: Northing: Easting:

Bio/Chem: Bottom Depth ________ Penetration Depth ________ RPD Depth ________

Sediment Type: Cobble Gravel Sand C M F Silt Clay

Large Fauna: Starfish Worms Clams Crabs ________

Sediment Colors: Gray Black Light Brown Dark Brown ________

Sediment Odor: H_2S Petroleum None Slight Moderate Strong Overwhelming

Photo Log: Roll No. ________ Photo No. ________

Comments: ________

Deployment No: ________ Time: ________ Northing: ________ Easting: ________

Bio/Chem: Bottom Depth ________ Penetration Depth ________ RPD Depth ________

Sediment Type: Cobble Gravel Sand C M F Silt Clay

Large Fauna: Starfish Worms Clams Crabs ________

Sediment Colors: Gray Black Light Brown Dark Brown ________

Sediment Odor: H_2S Petroleum None Slight Moderate Strong Overwhelming

Photo Log: Roll No. ________ Photo No. ________

Comments: ________

Deployment No: ________ Time: ________ Northing: ________ Easting: ________

Bio/Chem: Bottom Depth ________ Penetration Depth ________ RPD Depth ________

Sediment Type: Cobble Gravel Sand C M F Silt Clay

Large Fauna: Starfish Worms Clams Crabs ________

Sediment Colors: Gray Black Light Brown Dark Brown ________

Sediment Odor: H_2S Petroleum None Slight Moderate Strong Overwhelming

Photo Log: Roll No. ________ Photo No. ________

Comments: ________

Analyses

- ☐ **Chemistry Lab**
- ☐ Conventionals
  - ☐ Acid Vol. Sulfates
  - ☐ Sim. Ext. Metals
  - ☐ Cation Exchange
  - ☐ Ammonia
  - ☐ Chloride
  - ☐ TOC
  - ☐ Grainsize
  - ☐ TAL Metals
  - ☐ Cyanide
- ☐ BTEX/PAHs
  - ☐ BTEX
  - ☐ PAHs
- ☐ Organics
  - ☐ TCL VOCs
  - ☐ TCL SVOCs
  - ☐ TCL Pesticides/PCAs

- ☐ **Benthic Lab**
- ☐ Benthic Counts

Comments:

Foster Wheeler Environmental
CORE LOGGING FORM

Project _____

SAMPLING STATION: _____ Date_____Deployment Time:_____

STATION DESCRIPTION:_____

DEPTH TO MUDLINE:_____Feet LOCATION: N _____ E _____

Predicted Tide :_____ Water Surface Elevation:_____MLLW

TYPE OF CORE (circle one) VIBRACORE GRAVITY PISTON HAND CORER

MODEL _____ Samplers_____

TUBE LENGTH:_____Feet Tube Type:_____ Liner Type:_____

Core Penetration: _____ (ft below mudline) Recovered Core length:_____ Percent Compaction: _____

Compacted Core sections: ____to____ ___to___ ___to___ ___to___ ___to___ ___to___
____to____ ___to___ ___to___ ___to___ ___to___ ___to___

Expanded Core sections: ____to____ ___to___ ___to___ ___to___ ___to___ ___to___
____to____ ___to___ ___to___ ___to___ ___to___ ___to___

NOTES:

Depth	Core		Description(soil type, color, MC, odor etc)		Other notes, Insitu tests
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Foster Wheeler Environmental
CORE LOGGING FORM

Project _____

SAMPLING STATION: _____ Date_____

STATION DESCRIPTION:_____

Depth	Core	Description(soil type, color, MC, odor etc)	Other notes, Insitu tests
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

EQUIPMENT CALIBRATION AND MAINTENANCE FORM (TYPICAL)

INSTRUMENT (NAME / MODEL NO. / SERIAL NO.): _____

MANUFACTURER: _____ DATE PURCHASED or LEASED: _____

CALIBRATION LOGSHEET

Calibration Date	Initial Settings	Standard(s) Used	Procedure	Adjustments Made	Final Settings	Signature of Operator	Comments

MAINTENANCE LOGSHEET

Maintenance Date	Reason for Maintenance	Maintenance Performed	Signature of Operator	Comments

FIELD CHANGE REQUEST (FCR) FORM (TYPICAL)

Project Name: _____ Project No.: _____
Client: _____ Request No.: FCR-_____

To: _____ Date: _____

Field Change Request Title: _____

Description:

_____
_____
_____

Reason for Change:

_____
_____
_____

Recommended Disposition:

_____
_____

_____ _____ _____
Field Operations Lead (or designee) Signature Date

Disposition:

_____
_____

_____ _____ _____
Project Manager Signature Date

Approval:

_____ _____ _____
Project Manager Signature Date

Distribution:
GCRRF Council Project Manager QA Officer
Foster Wheeler Environmental Project Manager Project File
Field Operations Lead Other:

APPENDIX C

ACCESS AGREEMENTS

GRAND CALUMET RIVER RESTORATION FUND COUNCIL

July 24, 2002

Mr. Bill Crowham, Operations Manager
Great Lakes Warehouse
700 State Street
Calumet City, IL 60409

Dear Mr. Crowham: T. J. Crohan

Re: Great Lakes Warehouse, Hammond
Township 37 N; Range 10W; Section 36

As discussed this afternoon, the Grand Calumet River Restoration Fund Council seeks access to the west branch of Grand Calumet River to collect samples for chemical, geophysical and toxicological characterization, for survey and bathymetric data collection. The Council is charged with implementation of sediment cleanup and natural resource restoration of the west branch Grand Calumet River under auspices of the Hammond Sanitary District Settlements. Those settlements resolved certain violations of the Clean Water and other Federal/State Acts. The sole purpose of this work is to provide the Council sufficient information to make decisions on need for cleanup and development of restoration alternatives that could be implemented with public concurrence.

This characterization work is tentatively planned for late September or early October 2002. The characterization will be restricted to the river and adjacent banks from Indianapolis Boulevard to the State Line.

We respectfully request permission to access the river from the Great Lakes Warehouse property at 11 Industrial Road, Hammond, Indiana. We would request access through your gate and use of a small portion of your parking lot immediately adjacent to the river. This area would be used to establish a staging area for equipment (Jon boats, vibracore samplers, etc.) and supplies and sample processing: removing from core samplers and placing in bottles for shipment.

I have attached an aerial photo outlining the portion of Great Lakes property we seek access to and the reach of Grand Calumet River that this site would provide access to for our characterization work. I have also attached a sample copy of a recent access agreement that Indiana Department of Environmental Management has utilized for access to sites on the west branch Grand Calumet River.

Please contact me at the address or phone listed below to discuss the access agreement or any aspect of the river characterization. Thank you for your cooperation in our efforts to cleanup and restore the west branch Grand Calumet River.

Sincerely,

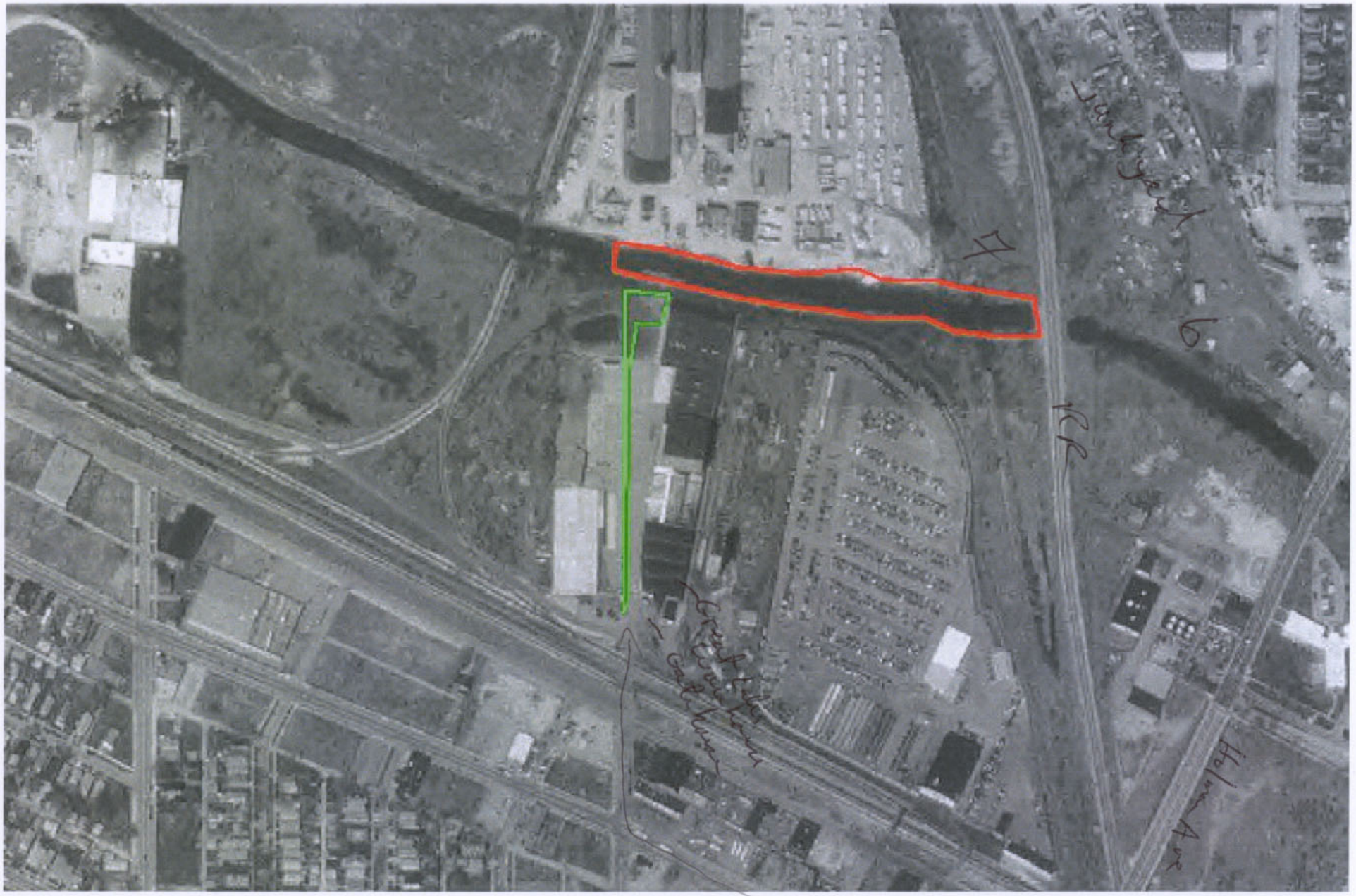
Jim Smith
Office of Land Quality, IDEM

Attachment (2)

Cc: Mary Ann Habeeb, IDEM
Dan Sparks, USFWS

Jim Smith
Indiana Department of Environmental Management
Office of Land Quality
100 N. Senate Avenue, N-1101
P.O. Box 6015
Indianapolis, IN 46206-6015
(317) 232-3451
jsmith@dem.state.in.us

Great Lakes Access Site - Grand Calumet River



GRAND CALUMET RIVER RESTORATION FUND COUNCIL

July 24, 2002

Brian Stage
Northern Indiana Public Service Company
801 E. 86th Ave.
Merrillville, IN 46410

Dear Mr. Stage:

Re: Roxana Marsh Properties, East Chicago
Township 37 N; Range 9W; Section 32
and: Hohman Avenue Property, Hammond
Township 37 N; Range 10W, Sections 36 and 25

The Grand Calumet River Restoration Fund Council seeks access to the west branch of Grand Calumet River to collect samples for chemical, geophysical and toxicological characterization, for survey and bathymetric data collection. The Council is charged with implementation of sediment cleanup and natural resource restoration of the west branch Grand Calumet River under auspices of the Hammond Sanitary District Settlements. Those settlements resolved certain violations of the Clean Water and other Federal/State Acts. The sole purpose of this work is to provide the Council sufficient information to make decisions on need for cleanup and development of restoration alternatives that could be implemented with public concurrence.

The characterization work is tentatively planned for late September or early October, 2002. The characterization will be restricted to the river and adjacent banks from Indianapolis Boulevard to the State Line.

We respectfully request permission to access the river from NIPSCO property at and near Roxana Marsh and to establish a staging area for equipment and supplies during characterization activities. We hope to use this property for work between Indianapolis Blvd. and Columbia Drive.

Additionally, we request access to the river adjacent to the Hohman Avenue Manufactured Gas Plant site. Activities on the River adjacent to this site will be restricted to Bathymetric and survey work; no samples are anticipated to be collected in this river reach.

I have attached aerial photos of the NIPSCO properties with river reach to be accessed from these sites. Hopefully a simple modification of our previous access agreement would accommodate our needs.

Please contact me at the address or phone listed below to discuss the access agreement or characterization work planned.

Thank you for your cooperation in our efforts to cleanup and restore the west branch Grand Calumet River.

Sincerely,

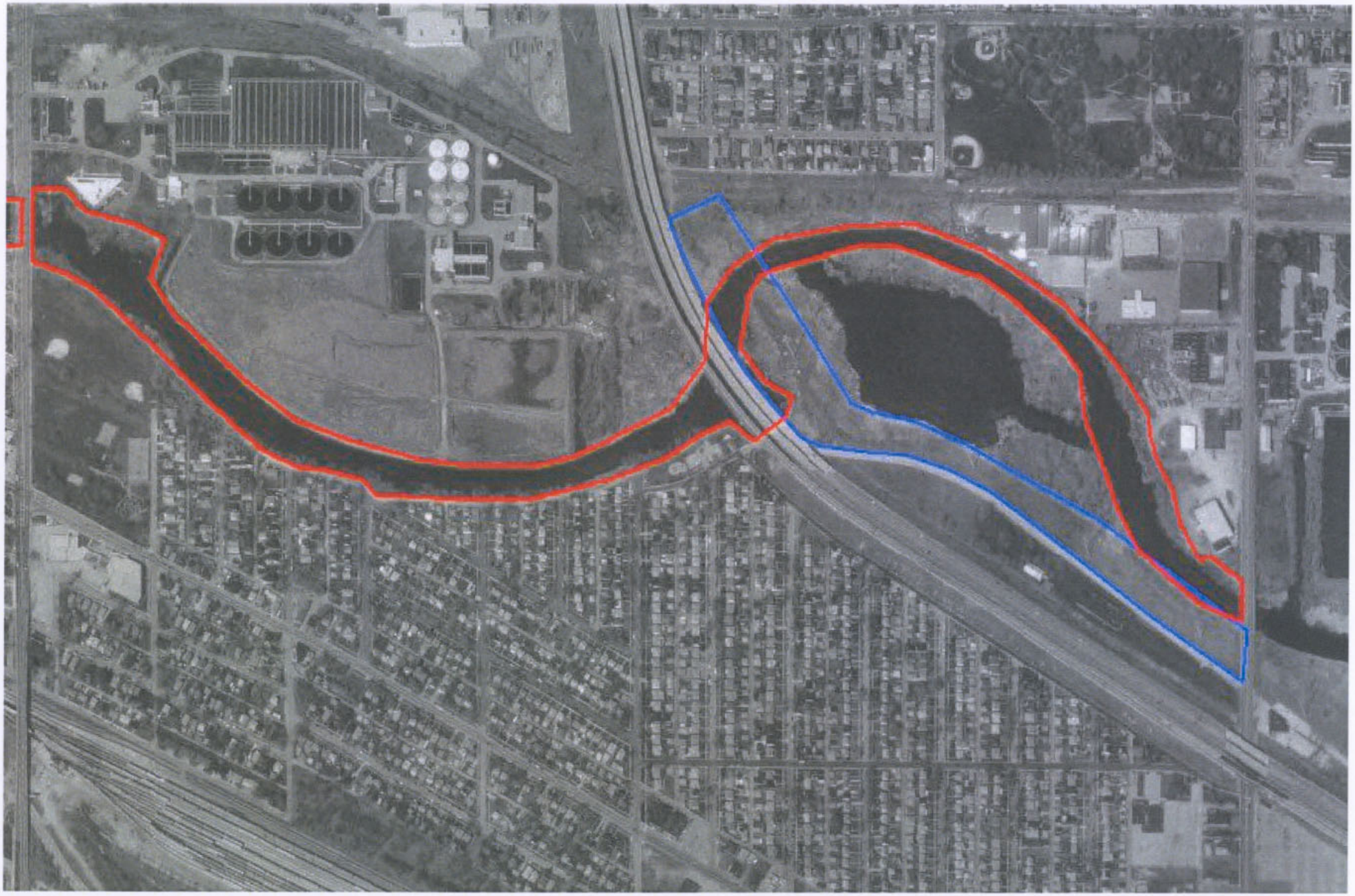
Jim Smith
Office of Land Quality, IDEM

Attachment (2)

cc: Mary Ann Habeeb, IDEM
Dan Sparks, USFWS

Jim Smith
Indiana Department of Environmental Management
Office of Land Quality
100 N. Senate Avenue, N-1101
P.O. Box 6015
Indianapolis, IN 46206-6015
(317) 232-3451
jsmith@dem.state.in.us

Roxana Marsh Reach - NIPSCO Access



NIPSCO MGP SITE

GRAND CALUMET RIVER RESTORATION FUND COUNCIL

July 24, 2002

Mr. Curt Vosti, Director
Hammond Parks and Recreation
Hammond Civic Center
5825 Sohl Avenue
Hammond, IN 46320

Dear Mr. Vosti:

Re: Turner Park, Hammond
Township 37 N; Range 10W; Section 36

As discussed at our meeting last Thursday afternoon, the Grand Calumet River Restoration Fund Council seeks access to the west branch of Grand Calumet River to collect samples for chemical, geophysical and toxicological characterization, for survey and bathymetric data collection. The Council is charged with implementation of sediment cleanup and natural resource restoration of the west branch Grand Calumet River under auspices of the Hammond Sanitary District Settlements. Those settlements resolved certain violations of the Clean Water and other Federal/State Acts. The sole purpose of this work is to provide the Council sufficient information to make decisions on need for cleanup and development of restoration alternatives that could be implemented with public concurrence.

This characterization work is tentatively planned for late September or early October, 2002. The characterization will be restricted to the river and adjacent banks from Indianapolis Boulevard to the State Line.

We respectfully request permission to access the river from Hammond Parks and Recreation property in Turner Park at Sohl Avenue just south of the river. Turner Park would provide us access to the river from Columbia Avenue to Hohman Avenue. We would like to use this area to establish a staging area for equipment and supplies and sample processing: removing from core samplers and placed in bottles for shipment.

I have attached an aerial photo outlining the portion of Turner Park we seek access to and the reach of Grand Calumet River that this site would provide access to for our characterization work. I have also attached a sample copy of a recent access agreement that Indiana Department of Environmental Management has utilized for access to sites on the west branch Grand Calumet River if the Parks Board requires such an agreement.

Please contact me at the address or phone listed below to discuss the access agreement. Thank you for meeting with Mr. Dan Sparks of the USFWS and I last Thursday and for your cooperation in our efforts to cleanup and restore the west branch Grand Calumet River.

Sincerely,

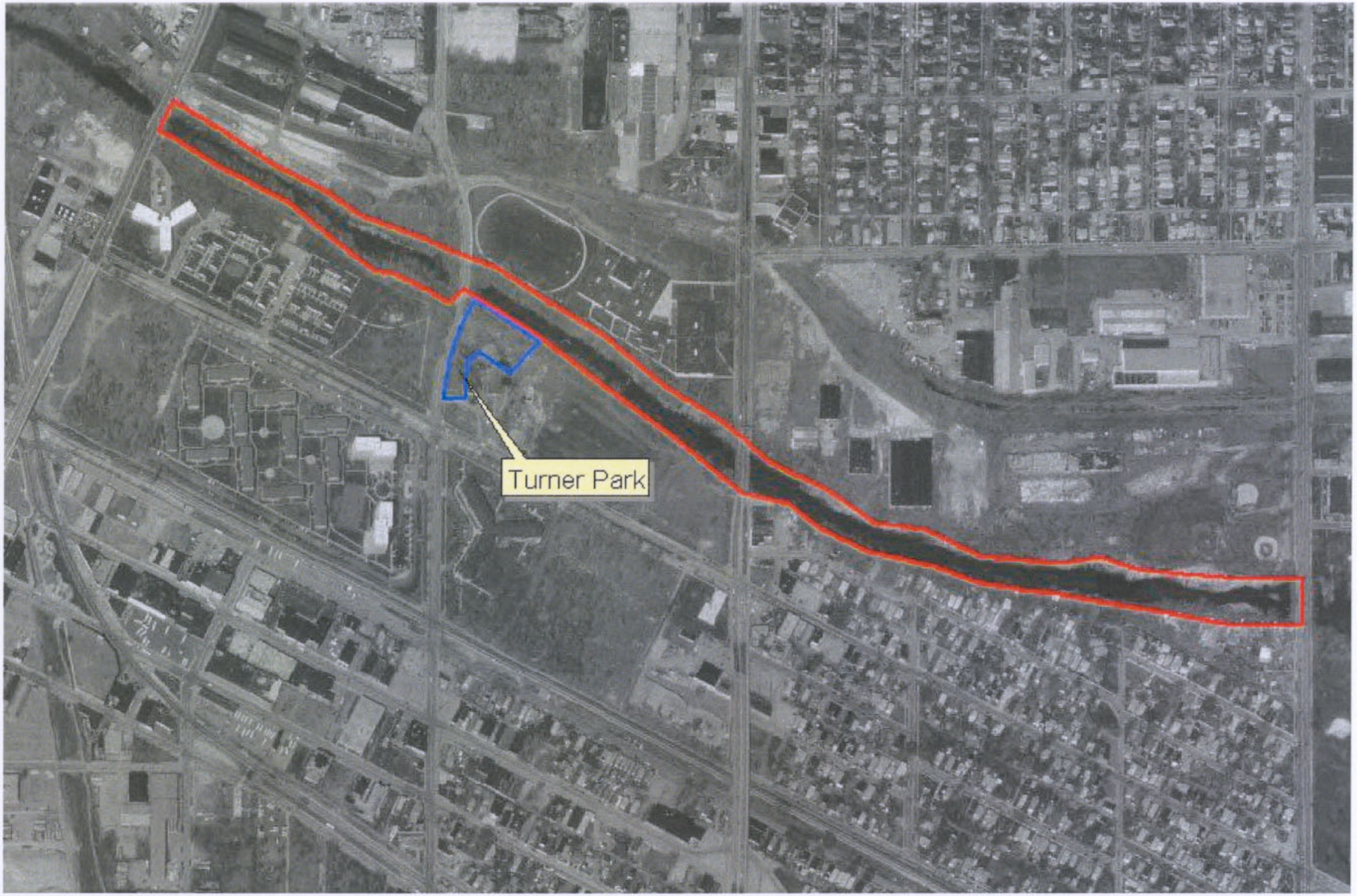
Jim Smith
Office of Land Quality, IDEM

Attachment (2)

Cc: Mary Ann Habeeb
Dan Sparks

Jim Smith
Indiana Department of Environmental Management
Office of Land Quality
100 N. Senate Avenue, N-1101
P.O. Box 6015
Indianapolis, IN 46206-6015
(317) 232-3451
jsmith@dem.state.in.us

Hammond Parks & Recreation Turner Park



APPENDIX D

SUMMARY TABLE OF HISTORICAL DATA

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	RM 01RA01SE00	RM 01RA01SE07	RM 01RA02SE00	RM 01RA02SE07	RM 01RB01SE00	RM 01RB01SE07	RM 01RC01SE00	RM 01RC01SE07	RM 01RC02SE00	RM 01RC02SE07
Location											
Depth	feet	0-0.16	2-3.7	0-0.16	2-5.5	0-0.16	2-7	0-2	2-6.5	0-5	2-3.5
Latitude		41.6169	41.6169	41.6182	41.6182	41.6179	41.6179	41.6168	41.6168	41.6175	41.6175
Longitude		-87.4867	-87.4867	-87.4877	-87.4877	-87.4859	-87.4859	-87.4853	-87.4853	-87.4843	-87.4843
Conventionals											
Acid volatile sulfides	µmol/g										
Acid volatile sulfides	mg/kg										
Ammonia-nitrogen	mg/kg										
% clay sized particles	%										
% gravel sized particles	%										
% sand + gravel sized prtcls	%										
% sand sized particles	%										
% silt + clay sized particles	%										
% silt sized particles	%										
Metals											
Aluminum	mg/kg										
Antimony	mg/kg	6.7	<6	<6	<6	<6	<6	<6	<6	12.5	<6
Arsenic	mg/kg	8	3	0.96	1.9	7.9	2.4	7.5	2	13.2	1.5
Barium	mg/kg	144	39.9	<20	39.7	134	21.4	66.6	<20	112	26.4
Beryllium	mg/kg										
Boron	mg/kg										
Cadmium	mg/kg	4.4	<0.5	<0.5	<0.5	4.6	<0.5	1.9	<0.5	6.8	<0.5
Calcium	mg/kg										
Chromium	mg/kg	87.8	8	2.6	8.9	85.4	5.3	27.5	5.9	137	6.7
Cobalt	mg/kg										
Copper	mg/kg	198	11.5	9.3	10.6	212	5.5	56.1	6.7	137	6.9
Cyanide	mg/kg	<0.5	<0.5	1.1	<0.5	<0.5	<0.5	0.68	<0.5	10.7	<0.5
Iron	mg/kg	12800	8400	1730	9930	11600	7610	9170	7580	12600	8710
Lead	mg/kg	247	7.7	13.7	9.7	255	4.2	141	4.8	240	4.2
Lithium	mg/kg										
Magnesium	mg/kg										
Manganese	mg/kg										
Mercury	mg/kg	0.46	<0.1	<0.1	<0.1	0.45	<0.1	0.14	<0.1	0.67	<0.1
Molybdenum	mg/kg										
Nickel	mg/kg	40.4	16	4.4	15.6	39.9	7.1	27.4	10.3	35.6	10
Potassium	mg/kg	<500	<500	<500	<500	<500	<500	<500	525	<500	679
Selenium	mg/kg	5.3	0.36	0.97	0.28	5.3	<0.2	2.1	<0.2	6.4	<0.2
Silver	mg/kg	3.6	<1	<1	<1	3.6	<1	<1	<1	4.7	<1
Sodium	mg/kg										
Strontium	mg/kg										
Thallium	mg/kg										

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	RM 01RA01SE00	RM 01RA01SE07	RM 01RA02SE00	RM 01RA02SE07	RM 01RB01SE00	RM 01RB01SE07	RM 01RC01SE00	RM 01RC01SE07	RM 01RC02SE00	RM 01RC02SE07
Tin	mg/kg	152	<10	<10	<10	141	<10	39.2	<10	224	<10
Titanium	mg/kg										
Vanadium	mg/kg										
Zinc	mg/kg	737	36.1	72.2	36.8	709	19.6	288	24.7	694	30.2
Volatile Organic Compounds											
1,2,4-Trichlorobenzene	µg/kg										
1,2-Dichlorobenzene	µg/kg										
1,3-Dichlorobenzene	µg/kg										
1,4-Dichlorobenzene	µg/kg										
Benzene	µg/kg	<11	<7	<9.6	<5.5			<7.3	<5.6	<8.4	<8.4
Semi-Volatile Organic Compounds											
1,2,3,4-Tetrachlorobenzene	µg/kg										
1,2,3,5-Tetrachlorobenzene	µg/kg										
1,2-Dinitrobenzene	µg/kg										
1,2-Diphenylhydrazine	µg/kg										
1,3-Dinitrobenzene	µg/kg										
1,4-Dinitrobenzene	µg/kg										
2,2'-Oxybis(1-chloropropane)	µg/kg										
2,3,4,6-Tetrachlorophenol	µg/kg										
2,4,5-Trichlorophenol	µg/kg										
2,4,6-Trichlorophenol	µg/kg										
2,4-Dichlorophenol	µg/kg										
2,4-Dimethylphenol	µg/kg										
2,4-Dinitrophenol	µg/kg										
2,4-Dinitrotoluene	µg/kg										
2,6-Dinitrotoluene	µg/kg										
2-Chloronaphthalene	µg/kg										
2-Chlorophenol	µg/kg										
2-Methylnaphthalene	µg/kg	<660	<330	<660	<330	<660	<330	<330	<330	<330	<330
2-Methylphenol	µg/kg										
2-Nitroaniline	µg/kg										
2-Nitrophenol	µg/kg										
2-Picoline	µg/kg										
3,3'-Dichlorobenzidine	µg/kg										
3-Nitroaniline	µg/kg										
4,6-Dinitro-2-methylphenol	µg/kg										
4-Bromophenyl phenyl ether	µg/kg										
4-Chloro-3-methylphenol	µg/kg										
4-Chloroaniline	µg/kg										
4-Chlorophenyl phenyl ether	µg/kg										

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	RM 01RA01SE00	RM 01RA01SE07	RM 01RA02SE00	RM 01RA02SE07	RM 01RB01SE00	RM 01RB01SE07	RM 01RC01SE00	RM 01RC01SE07	RM 01RC02SE00	RM 01RC02SE07
4-Methylphenol	µg/kg										
4-Nitroaniline	µg/kg										
4-Nitrophenol	µg/kg										
Acenaphthene	µg/kg	<660	<330	<660	<330	<660	<330	<330	<330	<330	<330
Acenaphthylene	µg/kg	<660	<330	<660	<330	<660	<330	<330	<330	<330	<330
Aniline	µg/kg										
Anthracene	µg/kg	<660	<330	<660	<330	<660	<330	<330	<330	<330	<330
Benzidine	µg/kg										
Benzo(a)anthracene	µg/kg	<660	<330	<660	<330	<660	<330	<330	<330	<330	<330
Benzo(a)pyrene	µg/kg	<660	<330	<660	<330	<660	<330	<330	<330	<330	<330
Benzo(b)fluoranthene	µg/kg										
Benzo(g,h,i)perylene	µg/kg										
Benzo(k)fluoranthene	µg/kg	<660	<330	<660	<330	<660	<330	<330	<330	<330	<330
Benzoic acid	µg/kg										
Benzyl alcohol	µg/kg										
Bis(2-chloroethoxy)methane	µg/kg										
Bis(2-chloroethyl)ether	µg/kg										
Bis(2-ethylhexyl)phthalate	µg/kg										
Butylbenzylphthalate	µg/kg										
Carbazole	µg/kg										
Chrysene	µg/kg	<660	<330	<660	<330	<660	<330	400	<330	<330	<330
Dibenz(a,h)anthracene	µg/kg	<660	<330	<660	<330	<660	<330	<330	<330	<330	<330
Dibenzofuran	µg/kg										
Diethylphthalate	µg/kg										
Dimethylphthalate	µg/kg										
Di-n-butyl phthalate	µg/kg										
Di-n-octylphthalate	µg/kg										
Fluoranthene	µg/kg	<660	<330	<660	<330	<660	<330	530	<330	<330	<330
Fluorene	µg/kg	<660	<330	<660	<330	<660	<330	<330	<330	<330	<330
Hexachlorobenzene	µg/kg										
Hexachlorobutadiene	µg/kg										
Hexachlorocyclopentadiene	µg/kg										
Hexachloroethane	µg/kg										
Indeno(1,2,3-c,d)pyrene	µg/kg	<660	<330	<660	<330	<660	<330	<330	<330	<330	<330
Isophorone	µg/kg										
Naphthalene	µg/kg	<11	<7	<9.6	<5.5	<11	<5.9	<7.3	<5.6	<8.4	<8.4
Nitrobenzene	µg/kg										
N-nitrosodimethylamine	µg/kg										
N-nitrosodi-N-propylamine	µg/kg										
N-nitrosodiphenylamine	µg/kg										
Pentachlorophenol	µg/kg										

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	RM 01RA01SE00	RM 01RA01SE07	RM 01RA02SE00	RM 01RA02SE07	RM 01RB01SE00	RM 01RB01SE07	RM 01RC01SE00	RM 01RC01SE07	RM 01RC02SE00	RM 01RC02SE07
Phenanthrene	µg/kg	<660	<330	<660	<330			<330	<330	<330	<330
Phenol (µg/kg units)	µg/kg	<660	<330	<660	<330			<330	<330	<330	<330
Phenol (mg/kg units)	mg/kg										
Pyrene	µg/kg	<660	<330	<660	<330	700		620	<330	<330	<330
Pyridine	µg/kg										
TIC	µg/kg										
Toluene-2,4-diamine	µg/kg										
Total HMW-PAHs (13 PAHs)	µg/kg	<3960	<1980	<3960	<1980	2350	<1650	2045	<1980	<1980	<1980
Total HMW-PAHs***	µg/kg	<3300	<1650	<3300	<1650	2020	<1320	1880	<1650	<1650	<1650
Total LMW-PAHs (13 PAHs)	µg/kg	<3971	<1987	<3969.6	<1985.5	<3311	<1655.9	<1987.3	<1985.6	<1988.4	<1988.4
Total LMW-PAHs***	µg/kg	<1331	<997	<1329.6	<995.5	<671	<665.9	<997.3	<995.6	<998.4	<998.4
Total PAHs (13 PAHs)	µg/kg	<7931	<3967	<7929.6	<3965.5	4005.5	<3305.9	3038.65	<3965.6	<3968.4	<3968.4
Total PAHs***	µg/kg	<4631	<2647	<4629.6	<2645.5	2355.5	<1985.9	2378.65	<2645.6	<2648.4	<2648.4
Unknown	µg/kg										
Polychorinated Biphenyls											
Aroclor 1016	µg/kg	<3300	<160	<33	<33	<3300	<33	<660	<33	<33	<160
Aroclor 1221	µg/kg	<3300	<160	<33	<33	<3300	<33	<660	<33	<33	<160
Aroclor 1232	µg/kg	<3300	<160	<33	<33	<3300	<33	<660	<33	<33	<160
Aroclor 1242	µg/kg	<3300	<160	<33	<33	<3300	<33	<660	<33	<33	<160
Aroclor 1248	µg/kg	<3300	<160	<33	<33	<3300	<33	<660	<33	<33	<160
Aroclor 1254	µg/kg	<3300	<160	32	<33	<3300	<33	<660	<33	130	<160
Aroclor 1260	µg/kg	<3300	<160	<33	<33	<3300	<33	<660	<33	<33	<160
Total PCBs	µg/kg	<23100	<1120	131	<231	<23100	<231	<4620	<231	229	<1120
Total PCBs**	µg/kg			32						130	
Pesticides											
Aldrin	µg/kg										
Chlordane	µg/kg	<340	<68	<34	<34	<340	<3.4	<340	<3.4	<124	<34
Chlordane - alpha	µg/kg	<170	<34	<17	<17	<170	<1.7	<170	<1.7	<85	<17
Chlordane - gamma	µg/kg	<170	<34	<17	<17	<170	<1.7	<170	<1.7	<39	<17
Chlordane - reported*	µg/kg										
Dieldrin	µg/kg	<340	<68	<34	<34	<340	<3.4	<340	<3.4	<170	<34
Dieldrin only (not Aldrin)	µg/kg						<3.4		<3.4		
Endosulfan sulfate	µg/kg										
Endosulfan-alpha	µg/kg										
Endosulfan-beta	µg/kg										
Endrin	µg/kg	<340	<68	<34	<34	<340	<3.4	<340	<3.4	<170	<34
Endrin ketone	µg/kg										
Heptachlor	µg/kg	<170	<34	<17	<17	<170	<1.7	<170	<1.7	<85	<17
Heptachlor + Hept. epox.**	µg/kg										
Heptachlor epoxide	µg/kg	<170	<34	<17	<17	<170	<1.7	<170	<1.7	<85	<17
Hexachlorocyclohexane**	µg/kg						<1.7		<1.7		

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	RM 01RA01SE00	RM 01RA01SE07	RM 01RA02SE00	RM 01RA02SE07	RM 01RB01SE00	RM 01RB01SE07	RM 01RC01SE00	RM 01RC01SE07	RM 01RC02SE00	RM 01RC02SE07
Hexachlorocyclohexane-α	µg/kg										
Hexachlorocyclohexane-β	µg/kg										
Hexachlorocyclohexane-δ	µg/kg										
Lindane	µg/kg	<170	<34	<17	<17	<170	<1.7	<170	<1.7	<85	<17
Methoxychlor	µg/kg										
o,p'-DDD	µg/kg										
o,p'-DDE	µg/kg										
o,p'-DDT	µg/kg										
p,p'-DDD	µg/kg	<340	<68	<34	<34	<340	<3.4	<340	<3.4	<170	<34
p,p'-DDE	µg/kg	<340	<68	<34	<34	<340	<3.4	<340	<3.4	<170	<34
p,p'-DDT	µg/kg	<340	<68	<34	<34	<340	<3.4	<340	<3.4	<170	<34
Sum DDD	µg/kg										
Sum DDD**	µg/kg										
Sum DDE	µg/kg										
Sum DDE**	µg/kg										
Sum DDT	µg/kg										
Sum DDT**	µg/kg										
Total DDT	µg/kg	<1020	<204	<102	<102	<1020	<10.2	<1020	<10.2	<510	<102
Total DDT**	µg/kg										
Total DDT***	µg/kg			<34	<34		<10.2		<10.2		<34
Toxaphene	µg/kg	<6700	<1300	<670	<670	<6700	<67	<6700	<67	<3400	<670
Dioxins											
2,3,7,8-Dibenzo-p-dioxin	µg/kg										

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	1 01RA03SD10	1 01RA03SE00	1 01RA03SE10	1 01RB03SD10	1 01RB03SE05	1 01RB03SE10	1 01RB03SE15	1 01RC03SE00	1 01RC03SE10	1 035-88
Location											
Depth	feet	5-8	0-0.16	5-8	5-10	0-5	5-10	10-13	0-0.16	5-9.5	Surface
Latitude		41.6188	41.6188	41.6188	41.6188	41.6188	41.6188	41.6188	41.6179	41.6179	41.6144
Longitude		-87.4881	-87.4881	-87.4881	-87.4859	-87.4859	-87.4859	-87.4859	-87.4838	-87.4838	-87.4806
Conventionals											
Acid volatile sulfides	µmol/g										
Acid volatile sulfides	mg/kg										
Ammonia-nitrogen	mg/kg										
% clay sized particles	%										
% gravel sized particles	%										
% sand + gravel sized prtcls	%										
% sand sized particles	%										
% silt + clay sized particles	%										
% silt sized particles	%										
Metals											
Aluminum	mg/kg										18700
Antimony	mg/kg	<6	7.1	<6	<6	6.9	<6	<6	<6	<6	12.5
Arsenic	mg/kg	1.9	18.3	1.8	8.8	37.9	7.4	3	21.5	3.6	109
Barium	mg/kg	27	217	28.9	33.3	134	31.7	27.8	110	<20	251
Beryllium	mg/kg										<1.6
Boron	mg/kg										
Cadmium	mg/kg	<0.5	5.9	<0.5	1.3	11.6	1.1	<0.5	4.5	<0.5	24.1
Calcium	mg/kg										127000
Chromium	mg/kg	6.7	160	6.8	6.9	213	5.9	7.3	188	4.3	469
Cobalt	mg/kg										<15.6
Copper	mg/kg	7.6	213	8.4	26	195	19.8	7.1	113	4.6	381
Cyanide	mg/kg	<0.5	7.6	<0.5	<0.5	1.6	<0.5	<0.5	6.2	<0.5	0.98
Iron	mg/kg	9790	21200	10300	12000	64600	12300	10400	10700	5210	20700
Lead	mg/kg	5.9	747	5.2	91.6	1640	99	5.5	212	9.1	1020
Lithium	mg/kg										
Magnesium	mg/kg										10400
Manganese	mg/kg										425
Mercury	mg/kg	<0.1	0.75	<0.1	0.23	0.76	0.23	<0.1	0.35	<0.1	1.92
Molybdenum	mg/kg										
Nickel	mg/kg	11.2	72.9	11	9.3	44.4	7.7	10.6	94.4	6.4	1140
Potassium	mg/kg	646	<500	655	615	<500	<500	768	<500	<500	<1560
Selenium	mg/kg	<0.2	4.5	<0.2	0.37	1.4	0.32	<0.2	3.3	<0.2	7.9
Silver	mg/kg	<1	5.8	<1	<1	7.7	<1	<1	5.5	<1	3.1
Sodium	mg/kg										<1560
Strontium	mg/kg										
Thallium	mg/kg										<6.3

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	1 01RA03SD10	1 01RA03SE00	1 01RA03SE10	1 01RB03SD10	1 01RB03SE05	1 01RB03SE10	1 01RB03SE15	1 01RC03SE00	1 01RC03SE10	1 035-88
Tin	mg/kg	<10	279	<10	<10	99.3	<10	<10	359	<10	
Titanium	mg/kg										
Vanadium	mg/kg										<15.6
Zinc	mg/kg	25.2	1040	26.7	261	2250	203	28.1	761	20.4	3190
Volatile Organic Compounds											
1,2,4-Trichlorobenzene	µg/kg										
1,2-Dichlorobenzene	µg/kg										
1,3-Dichlorobenzene	µg/kg										
1,4-Dichlorobenzene	µg/kg										
Benzene	µg/kg							<7.2	<48000	<7.6	19
Semi-Volatile Organic Compounds											
1,2,3,4-Tetrachlorobenzene	µg/kg										
1,2,3,5-Tetrachlorobenzene	µg/kg										
1,2-Dinitrobenzene	µg/kg										
1,2-Diphenylhydrazine	µg/kg										
1,3-Dinitrobenzene	µg/kg										
1,4-Dinitrobenzene	µg/kg										
2,2'-Oxybis(1-chloropropane)	µg/kg										
2,3,4,6-Tetrachlorophenol	µg/kg										
2,4,5-Trichlorophenol	µg/kg										
2,4,6-Trichlorophenol	µg/kg										
2,4-Dichlorophenol	µg/kg										
2,4-Dimethylphenol	µg/kg										
2,4-Dinitrophenol	µg/kg										
2,4-Dinitrotoluene	µg/kg										
2,6-Dinitrotoluene	µg/kg										
2-Chloronaphthalene	µg/kg										
2-Chlorophenol	µg/kg										
2-Methylnaphthalene	µg/kg	<330	<8200	<330	<330	11000	<330	<330	170000	<330	<5700
2-Methylphenol	µg/kg										
2-Nitroaniline	µg/kg										
2-Nitrophenol	µg/kg										
2-Picoline	µg/kg										
3,3'-Dichlorobenzidine	µg/kg										
3-Nitroaniline	µg/kg										
4,6-Dinitro-2-methylphenol	µg/kg										
4-Bromophenyl phenyl ether	µg/kg										
4-Chloro-3-methylphenol	µg/kg										
4-Chloroaniline	µg/kg										
4-Chlorophenyl phenyl ether	µg/kg										

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	1 01RA03SD10	1 01RA03SE00	1 01RA03SE10	1 01RB03SD10	1 01RB03SE05	1 01RB03SE10	1 01RB03SE15	1 01RC03SE00	1 01RC03SE10	1 035-88
4-Methylphenol	µg/kg										
4-Nitroaniline	µg/kg										
4-Nitrophenol	µg/kg										
Acenaphthene	µg/kg	<330	<8200	<330	<330	4100	<330	<330	100000	<330	<5700
Acenaphthylene	µg/kg	<330	<8200	<330	<330	<3300	<330	<330	59000	<330	1600
Aniline	µg/kg										
Anthracene	µg/kg	<330	<8200	<330	<330	6500	<330	<330	<50000	<330	2200
Benzidine	µg/kg										
Benzo(a)anthracene	µg/kg	<330	<8200	<330	<330	8500	<330	<330	<50000	<330	6500
Benzo(a)pyrene	µg/kg	<330	<8200	<330	<330	<3300	<330	<330	<50000	<330	6300
Benzo(b)fluoranthene	µg/kg										
Benzo(g,h,i)perylene	µg/kg										
Benzo(k)fluoranthene	µg/kg	<330	<8200	<330	<330	<3300	<330	<330	<50000	<330	5800
Benzoic acid	µg/kg										
Benzyl alcohol	µg/kg										
Bis(2-chloroethoxy)methane	µg/kg										
Bis(2-chloroethyl)ether	µg/kg										
Bis(2-ethylhexyl)phthalate	µg/kg										
Butylbenzylphthalate	µg/kg										
Carbazole	µg/kg										
Chrysene	µg/kg	<330	<8200	<330	<330	16000	350	<330	<50000	<330	7900
Dibenz(a,h)anthracene	µg/kg	<330	<8200	<330	<330	<3300	<330	<330	<50000	<330	750
Dibenzofuran	µg/kg										
Diethylphthalate	µg/kg										
Dimethylphthalate	µg/kg										
Di-n-butyl phthalate	µg/kg										
Di-n-octylphthalate	µg/kg										
Fluoranthene	µg/kg	<330	<8200	<330	<330	11000	330	<330	<50000	<330	17000
Fluorene	µg/kg	<330	<8200	<330	<330	6900	<330	<330	91000	<330	2300
Hexachlorobenzene	µg/kg										
Hexachlorobutadiene	µg/kg										
Hexachlorocyclopentadiene	µg/kg										
Hexachloroethane	µg/kg										
Indeno(1,2,3-c,d)pyrene	µg/kg	<330	<8200	<330	<330	<3300	<330	<330	<50000	<330	3500
Isophorone	µg/kg										
Naphthalene	µg/kg	<13	14	<13	<9.8	11000	<8.4	130	1300000	<7.6	<5700
Nitrobenzene	µg/kg										
N-nitrosodimethylamine	µg/kg										
N-nitrosodi-N-propylamine	µg/kg										
N-nitrosodiphenylamine	µg/kg										
Pentachlorophenol	µg/kg										

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	1 01RA03SD10	1 01RA03SE00	1 01RA03SE10	1 01RB03SD10	1 01RB03SE05	1 01RB03SE10	1 01RB03SE15	1 01RC03SE00	1 01RC03SE10	1 035-88
Phenanthrene	µg/kg	<330			550	39000	1000	<330	160000	330	8700
Phenol (µg/kg units)	µg/kg							<330	<50000	<330	
Phenol (mg/kg units)	mg/kg										<5.7
Pyrene	µg/kg		9700		360	24000	590	<330	<50000	<330	17000
Pyridine	µg/kg										
TIC	µg/kg										
Toluene-2,4-diamine	µg/kg										
Total HMW-PAHs (13 PAHs)	µg/kg	<1650	30200	<1650	1185	62800	1765	<1980	<300000	<1980	55450
Total HMW-PAHs***	µg/kg	<1320	9700	<1320	1020	59500	1600	<1650		<1650	55450
Total LMW-PAHs (13 PAHs)	µg/kg	<1993	20514	<1663	1379.9	80150	1829.2	1120	1905000	1158.8	23350
Total LMW-PAHs***	µg/kg	<1003	14	<673	884.9	78500	1334.2	625	1880000	663.8	14800
Total PAHs (13 PAHs)	µg/kg	<3643	50714	<3313	2564.9	142950	3594.2	2110	2055000	2148.8	78800
Total PAHs***	µg/kg	<2323	9714	<1993	1904.9	138000	2934.2	1450	1880000	1488.8	70250
Unknown	µg/kg										
Polychorinated Biphenyls											
Aroclor 1016	µg/kg	<33	<3300	<33	<330	<3300	<330	<33	<3300	<33	<375
Aroclor 1221	µg/kg	<33	<3300	<33	<330	<3300	<330	<33	<3300	<33	<375
Aroclor 1232	µg/kg	<33	<3300	<33	<330	<3300	<330	<33	<3300	<33	<375
Aroclor 1242	µg/kg	<33	<3300	<33	<330	<3300	<330	<33	<3300	<33	<375
Aroclor 1248	µg/kg	<33	<3300	<33	<330	<3300	<330	<33	<3300	<33	2187.5
Aroclor 1254	µg/kg	<33	<3300	<33	<330	<3300	<330	<33	<3300	<33	<375
Aroclor 1260	µg/kg	<33	<3300	<33	<330	<3300	<330	<33	<3300	<33	<375
Total PCBs	µg/kg	<231	<23100	<231	<2310	<23100	<2310	<231	<23100	<231	3312.5
Total PCBs**	µg/kg										
Pesticides											
Aldrin	µg/kg										
Chlordane	µg/kg	<17	<680	<17	<340	<1700	<340	<17	<3400	<34	<62.6
Chlordane - alpha	µg/kg	<8.5	<340	<8.5	<170	<850	<170	<8.5	<1700	<17	<31.3
Chlordane - gamma	µg/kg	<8.5	<340	<8.5	<170	<850	<170	<8.5	<1700	<17	<31.3
Chlordane - reported*	µg/kg										
Dieldrin	µg/kg	<17	<680	<17	<340	<1700	<340	<17	<3400	<34	<31.3
Dieldrin only (not Aldrin)	µg/kg										
Endosulfan sulfate	µg/kg										
Endosulfan-alpha	µg/kg										
Endosulfan-beta	µg/kg										
Endrin	µg/kg	<17	<680	<17	<340	<1700	<340	<17	<3400	<34	<312.5
Endrin ketone	µg/kg										
Heptachlor	µg/kg	<8.5	<340	<8.5	<170	<850	<170	<8.5	<1700	<17	<203.1
Heptachlor + Hept. epox.**	µg/kg										
Heptachlor epoxide	µg/kg	<8.5	<340	<8.5	<170	<850	<170	<8.5	<1700	<17	<156.3
Hexachlorocyclohexane**	µg/kg										

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	1 01RA03SD10	1 01RA03SE00	1 01RA03SE10	1 01RB03SD10	1 01RB03SE05	1 01RB03SE10	1 01RB03SE15	1 01RC03SE00	1 01RC03SE10	1 035-88
Hexachlorocyclohexane-α	µg/kg										
Hexachlorocyclohexane-β	µg/kg										
Hexachlorocyclohexane-δ	µg/kg										
Lindane	µg/kg	<8.5	<340	<8.5	<170	<850	<170	<8.5	<1700	<17	<31.3
Methoxychlor	µg/kg										
o,p'-DDD	µg/kg										<62.5
o,p'-DDE	µg/kg										<62.5
o,p'-DDT	µg/kg										<62.5
p,p'-DDD	µg/kg	<17	<680	<17	<340	<1700	<340	<17	<3400	<34	<62.5
p,p'-DDE	µg/kg	<17	<680	<17	<340	<1700	<340	<17	<3400	<34	<62.5
p,p'-DDT	µg/kg	<17	<680	<17	<340	<1700	<340	<17	<3400	<34	<62.5
Sum DDD	µg/kg										
Sum DDD**	µg/kg										
Sum DDE	µg/kg										
Sum DDE**	µg/kg										
Sum DDT	µg/kg										
Sum DDT**	µg/kg										
Total DDT	µg/kg	<51	<2040	<51	<1020	<5100	<1020	<51	<10200	<102	<375
Total DDT**	µg/kg										
Total DDT***	µg/kg	<51		<51				<51		<34	
Toxaphene	µg/kg	<340	<13000	<340	<6700	<34000	<6700	<340	<67000	<670	
Dioxins											
2,3,7,8-Dibenzo-p-dioxin	µg/kg										

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	1 087-94	1 R04822	1 RO5847	1 RO5848	1 RO5849	1 RO5850	1 ROX2-82	1 ROX2-84	1 ROX2-86	1 ROX2-88	1 ROX2-89
Location												
Depth	feet	Surface	Surface	0-4	0-0.5	0-4	0-0.3	0-3	3-6	6-7.8	0-3	3-6
Latitude		41.6144	41.61425	41.61484604	41.61484604	41.61439669	41.61439669	41.6188	41.6188	41.6188	41.6188	41.6188
Longitude		-87.4806	-87.48035	-87.48178924	-87.48178924	-87.4809618	-87.4809618	-87.4864	-87.4864	-87.4864	-87.4864	-87.4864
Conventionals												
Acid volatile sulfides	µmol/g											
Acid volatile sulfides	mg/kg											
Ammonia-nitrogen	mg/kg							392	284	201	349	275
% clay sized particles	%											
% gravel sized particles	%											
% sand + gravel sized prtcls	%											
% sand sized particles	%											
% silt + clay sized particles	%											
% silt sized particles	%											
Metals												
Aluminum	mg/kg	25100						7800	8800	7700	8100	8700
Antimony	mg/kg	71.8						8	12	10	13	9
Arsenic	mg/kg	55.4	55.3	130	85	210	74	<9.5	<9.7	<8.6	<13	<9.7
Barium	mg/kg	782	585	270	630	230	440	97	83	64	95	88
Beryllium	mg/kg	1.8						0.5	0.6	0.5	0.6	0.5
Boron	mg/kg											
Cadmium	mg/kg	29.2	21.5	57	30	33	57	1.7	<1.2	<1.1	<1.6	1.6
Calcium	mg/kg	92000						70000	52000	46000	72000	49000
Chromium	mg/kg	696	495	1200	790	860	850	62	25	19	51	30
Cobalt	mg/kg	15						9.8	9.5	8.6	9	9.6
Copper	mg/kg	879						41	40	28	38	43
Cyanide	mg/kg	11.1										
Iron	mg/kg	78700						22000	22000	19000	20000	25000
Lead	mg/kg	1460	2290	1800	1300	6800	1600	58	31	28	45	57
Lithium	mg/kg							15	20	17	18	17
Magnesium	mg/kg	13000						16000	21000	19000	17000	19000
Manganese	mg/kg	907						530	590	560	540	580
Mercury	mg/kg	4.4	5	2.7	5.1	3.8	3.6					
Molybdenum	mg/kg							2.8	2	<1.6	2.6	1.8
Nickel	mg/kg	418						31	30	23	32	31
Potassium	mg/kg	2030						940	1100	1100	1000	1100
Selenium	mg/kg	26.1	10.4	3.8	19	4.4	12					
Silver	mg/kg	32.3	16.9	<13	30	<18	19	<0.7	<0.7	<0.6	<0.9	<0.7
Sodium	mg/kg	1540						350	310	240	400	250
Strontium	mg/kg							68	46	38	70	45
Thallium	mg/kg	2.3										

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	1 087-94	1 R04822	1 RO5847	1 RO5848	1 RO5849	1 RO5850	1 ROX2-82	1 ROX2-84	1 ROX2-86	1 ROX2-88	1 ROX2-89
Tin	mg/kg							25	22	9.6	21	33
Titanium	mg/kg							150	180	140	170	160
Vanadium	mg/kg	46.9						16	18	16	17	19
Zinc	mg/kg	4860						220	150	93	160	180
Volatile Organic Compounds												
1,2,4-Trichlorobenzene	µg/kg			<13000	<16000	<17000	<71000					
1,2-Dichlorobenzene	µg/kg			<13000	<16000	<17000	<71000					
1,3-Dichlorobenzene	µg/kg			<13000	<16000	<17000	<71000					
1,4-Dichlorobenzene	µg/kg			<13000	<16000	<17000	<71000					
Benzene	µg/kg											
Semi-Volatile Organic Compounds												
1,2,3,4-Tetrachlorobenzene	µg/kg			<13000	<16000	<17000	<71000					
1,2,3,5-Tetrachlorobenzene	µg/kg			<13000	<16000	<17000	<71000					
1,2-Dinitrobenzene	µg/kg			<62000	<78000	<84000	<340000					
1,2-Diphenylhydrazine	µg/kg			<13000	<16000	<17000	<71000					
1,3-Dinitrobenzene	µg/kg			<62000	<78000	<84000	<340000					
1,4-Dinitrobenzene	µg/kg			<62000	<78000	<84000	<340000					
2,2'-Oxybis(1-chloropropane)	µg/kg			<13000	<16000	<17000	<71000					
2,3,4,6-Tetrachlorophenol	µg/kg			<62000	<78000	<84000	<340000					
2,4,5-Trichlorophenol	µg/kg			<62000	<78000	<84000	<340000					
2,4,6-Trichlorophenol	µg/kg			<13000	<16000	<17000	<71000					
2,4-Dichlorophenol	µg/kg			<13000	<16000	<17000	<71000					
2,4-Dimethylphenol	µg/kg			<13000	<16000	<17000	<71000					
2,4-Dinitrophenol	µg/kg			<62000	<78000	<84000	<340000					
2,4-Dinitrotoluene	µg/kg			<13000	<16000	<17000	<71000					
2,6-Dinitrotoluene	µg/kg			<13000	<16000	<17000	<71000					
2-Chloronaphthalene	µg/kg			<13000	<16000	<17000	<71000					
2-Chlorophenol	µg/kg			<13000	<16000	<17000	<71000					
2-Methylnaphthalene	µg/kg	<36000	<33000	66000	1300	340000	<71000	<1900	<3000	<3100	<3100	<3300
2-Methylphenol	µg/kg			<13000	<16000	<17000	<71000					
2-Nitroaniline	µg/kg			<62000	<78000	<84000	<340000					
2-Nitrophenol	µg/kg			<13000	<16000	<17000	<71000					
2-Picoline	µg/kg			<62000	<78000	<84000	<340000					
3,3'-Dichlorobenzidine	µg/kg			<26000	<32000	<35000	<140000					
3-Nitroaniline	µg/kg			<62000	<78000	<84000	<340000					
4,6-Dinitro-2-methylphenol	µg/kg			<62000	<78000	<84000	<340000					
4-Bromophenyl phenyl ether	µg/kg			<13000	<16000	<17000	<71000					
4-Chloro-3-methylphenol	µg/kg			<26000	<32000	<35000	<140000					
4-Chloroaniline	µg/kg			<26000	<32000	<35000	<140000					
4-Chlorophenyl phenyl ether	µg/kg			<13000	<16000	<17000	<71000					

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	1 087-94	1 R04822	1 RO5847	1 RO5848	1 RO5849	1 RO5850	1 ROX2-82	1 ROX2-84	1 ROX2-86	1 ROX2-88	1 ROX2-89
4-Methylphenol	µg/kg			<13000	<16000	<17000	<71000					
4-Nitroaniline	µg/kg			<62000	<78000	<84000	<340000					
4-Nitrophenol	µg/kg			<62000	<78000	<84000	<340000					
Acenaphthene	µg/kg	<3800	<33000	5200	1600	17000	9800	<1900	<3000	<3100	<3100	<3300
Acenaphthylene	µg/kg	810	<33000	<13000	4400	<17000	6400	<1900	<3000	<3100	<3100	<3300
Aniline	µg/kg			<13000	<16000	<17000	<71000					
Anthracene	µg/kg	1600	38000	42000	4100	140000	23000	<1900	<3000	<3100	<3100	<3300
Benzidine	µg/kg			<62000	<78000	<84000	<340000					
Benzo(a)anthracene	µg/kg	11000	73000	96000	25000	280000	110000	<1900	<3000	<3100	<3100	<3300
Benzo(a)pyrene	µg/kg	4600	34000	45000	28000	110000	48000	<1900	<3000	<3100	<3100	<3300
Benzo(b)fluoranthene	µg/kg		44000	41000	28000	99000	53000					
Benzo(g,h,i)perylene	µg/kg			34000	23000	89000	40000					
Benzo(k)fluoranthene	µg/kg	6500	13000	17000	23000	42000	25000	<1900	<3000	<3100	<3100	<3300
Benzoic acid	µg/kg			<62000	<78000	<84000	<340000					
Benzyl alcohol	µg/kg			<26000	<32000	<35000	<140000					
Bis(2-chloroethoxy)methane	µg/kg			<13000	<16000	<17000	<71000					
Bis(2-chloroethyl)ether	µg/kg			<13000	<16000	<17000	<71000					
Bis(2-ethylhexyl)phthalate	µg/kg			9300	81000	<17000	38000					
Butylbenzylphthalate	µg/kg			<13000	<16000	<17000	<71000					
Carbazole	µg/kg			11000	<78000	47000	<340000					
Chrysene	µg/kg	4500	150000	200000	35000	600000	250000	<1900	<3000	<3100	<3100	<3300
Dibenz(a,h)anthracene	µg/kg	2100	<33000	18000	10000	41000	<71000	<1900	<3000	<3100	<3100	<3300
Dibenzofuran	µg/kg		<33000	16000	<16000	59000	6900					
Diethylphthalate	µg/kg			<13000	<16000	<17000	<71000					
Dimethylphthalate	µg/kg			<13000	<16000	<17000	<71000					
Di-n-butyl phthalate	µg/kg			<13000	<16000	<17000	<71000					
Di-n-octylphthalate	µg/kg			<13000	<16000	<17000	<71000					
Fluoranthene	µg/kg	3800	44000	80000	33000	200000	84000	<1900	<3000	<3100	<3100	<3300
Fluorene	µg/kg	3000	10000	58000	3200	170000	28000	<1900	<3000	<3100	<3100	<3300
Hexachlorobenzene	µg/kg			<13000	<16000	<17000	<71000					
Hexachlorobutadiene	µg/kg			<13000	<16000	<17000	<71000					
Hexachlorocyclopentadiene	µg/kg			<13000	<16000	<17000	<71000					
Hexachloroethane	µg/kg			<13000	<16000	<17000	<71000					
Indeno(1,2,3-c,d)pyrene	µg/kg	2700	24000	23000	29000	50000	43000	<1900	<3000	<3100	<3100	<3300
Isophorone	µg/kg			<13000	<16000	<17000	<71000					
Naphthalene	µg/kg	<7500	<33000	17000	1200	98000	<71000	<1900	<3000	<3100	<3100	<3300
Nitrobenzene	µg/kg			<13000	<16000	<17000	<71000					
N-nitrosodimethylamine	µg/kg			<13000	<16000	<17000	<71000					
N-nitrosodi-N-propylamine	µg/kg			<13000	<16000	<17000	<71000					
N-nitrosodiphenylamine	µg/kg			<13000	<16000	<17000	<71000					
Pentachlorophenol	µg/kg			<62000	<78000	<84000	<340000					

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	1 087-94	1 R04822	1 RO5847	1 RO5848	1 RO5849	1 RO5850	1 ROX2-82	1 ROX2-84	1 ROX2-86	1 ROX2-88	1 ROX2-89
Phenanthrene	µg/kg	3500	38000	620000	8100	1900000	140000	<1900	<3000	<3100	<3100	<3300
Phenol (µg/kg units)	µg/kg		<33000	<13000	<16000	<17000	<71000	<1900	<3000	<3100	<3100	<3300
Phenol (mg/kg units)	mg/kg											
Pyrene	µg/kg	4100	110000	260000	51000	720000	240000	700	<3000	<3100	<3100	<3300
Pyridine	µg/kg			<13000	<16000	<17000	<71000					
TIC	µg/kg			384600	485000	214000	2242000					
Toluene-2,4-diamine	µg/kg			<62000	<78000	<84000	<340000					
Total HMW-PAHs (13 PAHs)	µg/kg	30100	427500	699000	182000	1951000	767500	5450	<18000	<18600	<18600	<19800
Total HMW-PAHs***	µg/kg	30100	411000	699000	182000	1951000	732000	1650				
Total LMW-PAHs (13 PAHs)	µg/kg	32560	152000	814700	23900	2673500	278200	<13300	<21000	<21700	<21700	<23100
Total LMW-PAHs***	µg/kg	8910	86000	808200	23900	2665000	207200					
Total PAHs (13 PAHs)	µg/kg	62660	579500	1513700	205900	4624500	1045700	12100	<39000	<40300	<40300	<42900
Total PAHs***	µg/kg	39010	497000	1507200	205900	4616000	939200	1650				
Unknown	µg/kg			251900	404000	765000	1030000					
Polychorinated Biphenyls												
Aroclor 1016	µg/kg	<1984.1	<170	<640	<1600	<880	<1400					
Aroclor 1221	µg/kg	<1984.1	<170	<640	<1600	<880	<1400					
Aroclor 1232	µg/kg	<1984.1	<170	<640	<1600	<880	<1400					
Aroclor 1242	µg/kg	<1984.1	<170	790	6500	250	6800					
Aroclor 1248	µg/kg	7936.5	4600	<640	<1600	<880	<1400					
Aroclor 1254	µg/kg	<1984.1	<350	<640	<1600	<880	<1400					
Aroclor 1260	µg/kg	<1984.1	1000	670	2200	840	1800					
Total PCBs	µg/kg	13888.8	6115	3060	12700	3290	12100					
Total PCBs**	µg/kg	7936.5										
Pesticides												
Aldrin	µg/kg			<32	<41	<44	<36					
Chlordane	µg/kg	<230.2		<64	160.5	<88	218					
Chlordane - alpha	µg/kg	<39.7		<32	140	<44	200					
Chlordane - gamma	µg/kg	<190.5		<32	<41	<44	<36					
Chlordane - reported*	µg/kg											
Dieldrin	µg/kg	<107.1		<64	<81	<88	120					
Dieldrin only (not Aldrin)	µg/kg											
Endosulfan sulfate	µg/kg			<64	<81	<88	<72					
Endosulfan-alpha	µg/kg			<32	<41	<44	<36					
Endosulfan-beta	µg/kg			<64	<81	<88	<72					
Endrin	µg/kg	<396.8		<64	<81	<88	<72					
Endrin ketone	µg/kg			<64	<81	<88	<72					
Heptachlor	µg/kg	<198.4		<32	<41	<44	<36					
Heptachlor + Hept. epox.**	µg/kg											
Heptachlor epoxide	µg/kg	<198.4		<32	<41	<44	<36					
Hexachlorocyclohexane**	µg/kg											

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	1 087-94	1 R04822	1 RO5847	1 RO5848	1 RO5849	1 RO5850	1 ROX2-82	1 ROX2-84	1 ROX2-86	1 ROX2-88	1 ROX2-89
Hexachlorocyclohexane-α	µg/kg			<32	<41	<44	<36					
Hexachlorocyclohexane-β	µg/kg			<32	<41	110	<36					
Hexachlorocyclohexane-δ	µg/kg			<32	<41	<44	<36					
Lindane	µg/kg	<39.7		<32	<41	<44	<36					
Methoxychlor	µg/kg			<320	<410	<440	<360					
o,p'-DDD	µg/kg	<138.9										
o,p'-DDE	µg/kg	<222.2										
o,p'-DDT	µg/kg	<79.4										
p,p'-DDD	µg/kg	178.6		70	200	<88	310					
p,p'-DDE	µg/kg	<178.6		<64	<81	<88	<72					
p,p'-DDT	µg/kg	<79.4		<64	<81	<88	180					
Sum DDD	µg/kg											
Sum DDD**	µg/kg	178.6										
Sum DDE	µg/kg											
Sum DDE**	µg/kg											
Sum DDT	µg/kg											
Sum DDT**	µg/kg											
Total DDT	µg/kg	527.85		134	281	<264	526					
Total DDT**	µg/kg	178.6										
Total DDT***	µg/kg	248.05		70	200		490					
Toxaphene	µg/kg	<793.7		<2000	<2600	<2800	<2300					
Dioxins												
2,3,7,8-Dibenzo-p-dioxin	µg/kg											

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	1 ROX2-90	1 ROX2-94	1 ROX2-95	1 UH 8.5	2 COL1-13	2 COL2-37	2 COL2-38	2 COL2-39	2 COL2-40	2 COL2-41	2 COL2-42	2 COL2-46	2 COL2-47
Location														
Depth	feet	6-7.2	0-3	0-3	0-9	0-1	0-3	3-6	6-7.2	0-3	3-6	6-7.1	0-3	0-3
Latitude		41.6188	41.6187	41.6188	41.61879	41.61866	41.61866	41.61866	41.61866	41.61866	41.61866	41.61866	41.6186	41.6188
Longitude		-87.4864	-87.4864	-87.48642	-87.48619	-87.4997	-87.4997	-87.4997	-87.4997	-87.4997	-87.4997	-87.4997	-87.4997	-87.4997
Conventionals														
Acid volatile sulfides	µmol/g													
Acid volatile sulfides	mg/kg													
Ammonia-nitrogen	mg/kg	207	542	203		112	262	938	2140	293	1040	2130	128	383
% clay sized particles	%													
% gravel sized particles	%													
% sand + gravel sized prtcls	%													
% sand sized particles	%													
% silt + clay sized particles	%													
% silt sized particles	%													
Metals														
Aluminum	mg/kg	6400	9800	7700		3300	3000	5900	16000	2800	6800	18000	3900	4300
Antimony	mg/kg	7	35	<7		13	16	38	27	14	31	19	9	19
Arsenic	mg/kg	<6.8	37	<12		5.3	5.5	100	38	<5.2	77	34	<5	18
Barium	mg/kg	66	410	80		110	170	170	340	170	180	330	230	260
Beryllium	mg/kg	0.4	1	0.4		0.4	0.4	0.7	1	0.3	0.6	1	0.6	0.4
Boron	mg/kg					<3.9	13	22	36	9.5	19	27		
Cadmium	mg/kg	1.3	17	<1.5	<10	2.8	3.9	17	23	4.4	15	12	2.5	7
Calcium	mg/kg	52000	54000	69000		22000	15000	21000	33000	17000	19000	35000	19000	19000
Chromium	mg/kg	22	320	38	59	47	84	41	120	60	72	97	44	120
Cobalt	mg/kg	8	13	8.8		3.1	4.4	6.7	9.4	5.2	6.3	11	4	4.7
Copper	mg/kg	30	400	21	105	330	260	450	330	240	370	240	180	300
Cyanide	mg/kg													
Iron	mg/kg	19000	85000	21000	34400	13000	25000	75000	53000	24000	58000	39000	19000	34000
Lead	mg/kg	33	1500	<12	558	150	480	1200	660	480	1500	430	710	800
Lithium	mg/kg	13	9.9	15		2.7	3.4	6.9	21	3.5	8.6	26	4	3.1
Magnesium	mg/kg	21000	9900	18000	8887	7000	6000	8900	12000	5800	8200	14000	6600	5800
Manganese	mg/kg	500	840	540	528	260	340	560	510	350	430	450	990	380
Mercury	mg/kg													
Molybdenum	mg/kg	<1.3	12	2.2		2.7	3.3	4.8	4.5	2.6	3	3.8	2.1	4.9
Nickel	mg/kg	20	85	26	49	20	28	24	32	29	22	35	22	51
Potassium	mg/kg	770	<900	780		210	<300	640	1800	<300	790	2100	<300	<400
Selenium	mg/kg													
Silver	mg/kg	<0.5	14	<0.9		7.5	4.5	3.2	1.8	3.5	2.3	1	2.6	6.5
Sodium	mg/kg	200	710	360		230	240	340	370	240	290	320	240	520
Strontium	mg/kg	42	99	65		29	27	32	63	32	32	64	39	50
Thallium	mg/kg													

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	1 ROX2-90	1 ROX2-94	1 ROX2-95	1 UH 8.5	2 COL1-13	2 COL2-37	2 COL2-38	2 COL2-39	2 COL2-40	2 COL2-41	2 COL2-42	2 COL2-46	2 COL2-47
Tin	mg/kg	25	230	<6		33	38	79	50	32	57	32	29	66
Titanium	mg/kg	130	200	150		110	110	170	250	100	150	220	170	110
Vanadium	mg/kg	14	29	17		9	10	19	30	10	17	31	11	14
Zinc	mg/kg	140	3400	76	1285	480	870	4200	5000	800	3600	2300	720	1200
Volatile Organic Compounds														
1,2,4-Trichlorobenzene	µg/kg													
1,2-Dichlorobenzene	µg/kg													
1,3-Dichlorobenzene	µg/kg													
1,4-Dichlorobenzene	µg/kg													
Benzene	µg/kg					<67								
Semi-Volatile Organic Compounds														
1,2,3,4-Tetrachlorobenzene	µg/kg													
1,2,3,5-Tetrachlorobenzene	µg/kg													
1,2-Dinitrobenzene	µg/kg													
1,2-Diphenylhydrazine	µg/kg													
1,3-Dinitrobenzene	µg/kg													
1,4-Dinitrobenzene	µg/kg													
2,2'-Oxybis(1-chloropropane)	µg/kg													
2,3,4,6-Tetrachlorophenol	µg/kg													
2,4,5-Trichlorophenol	µg/kg													
2,4,6-Trichlorophenol	µg/kg													
2,4-Dichlorophenol	µg/kg													
2,4-Dimethylphenol	µg/kg													
2,4-Dinitrophenol	µg/kg													
2,4-Dinitrotoluene	µg/kg													
2,6-Dinitrotoluene	µg/kg													
2-Chloronaphthalene	µg/kg													
2-Chlorophenol	µg/kg													
2-Methylnaphthalene	µg/kg	<2400	<32000	<4700		2000	4000	19000	230000	8300	79000	130000	<12000	18000
2-Methylphenol	µg/kg													
2-Nitroaniline	µg/kg													
2-Nitrophenol	µg/kg													
2-Picoline	µg/kg													
3,3'-Dichlorobenzidine	µg/kg													
3-Nitroaniline	µg/kg													
4,6-Dinitro-2-methylphenol	µg/kg													
4-Bromophenyl phenyl ether	µg/kg													
4-Chloro-3-methylphenol	µg/kg													
4-Chloroaniline	µg/kg													
4-Chlorophenyl phenyl ether	µg/kg													

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	1 ROX2-90	1 ROX2-94	1 ROX2-95	1 UH 8.5	2 COL1-13	2 COL2-37	2 COL2-38	2 COL2-39	2 COL2-40	2 COL2-41	2 COL2-42	2 COL2-46	2 COL2-47
4-Methylphenol	µg/kg													
4-Nitroaniline	µg/kg													
4-Nitrophenol	µg/kg													
Acenaphthene	µg/kg	<2400	<32000	<4700		<4600	<6600	17000	150000	<8200	50000	83000	<12000	5200
Acenaphthylene	µg/kg	<2400	<32000	<4700		<4600	<6600	<10500	<33000	<8200	<16000	<22000	<12000	<10500
Aniline	µg/kg													
Anthracene	µg/kg	<2400	5900	<4700		<4600	<6600	10700	72000	5300	29000	44000	<12000	7300
Benzidine	µg/kg													
Benzo(a)anthracene	µg/kg	<2400	19000	<4700	2180	3000	3500	18000	53000	12000	30000	32000	<12000	17000
Benzo(a)pyrene	µg/kg	<2400	15000	<4700	16730	3300	<6600	8900	23000	8000	14000	16000	<12000	9000
Benzo(b)fluoranthene	µg/kg													
Benzo(g,h,i)perylene	µg/kg													
Benzo(k)fluoranthene	µg/kg	<2400	32000	<4700	4520	1900	<6600	<10500	<33000	<8200	<16000	<22000	<12000	<10500
Benzoic acid	µg/kg													
Benzyl alcohol	µg/kg													
Bis(2-chloroethoxy)methane	µg/kg													
Bis(2-chloroethyl)ether	µg/kg													
Bis(2-ethylhexyl)phthalate	µg/kg													
Butylbenzylphthalate	µg/kg													
Carbazole	µg/kg													
Chrysene	µg/kg	<2400	41000	<4700	980	3400	5700	24000	56000	20000	44000	36000	6200	33000
Dibenz(a,h)anthracene	µg/kg	<2400	<32000	<4700		<4600	<6600	<10500	<33000	<8200	<16000	<22000	<12000	<10500
Dibenzofuran	µg/kg													
Diethylphthalate	µg/kg													
Dimethylphthalate	µg/kg													
Di-n-butyl phthalate	µg/kg													
Di-n-octylphthalate	µg/kg													
Fluoranthene	µg/kg	<2400	18000	<4700	1540	5000	5700	29000	80000	19000	48000	52000	7200	16000
Fluorene	µg/kg	<2400	6800	<4700		<4600	<6600	14000	71000	6000	32000	43000	<12000	8900
Hexachlorobenzene	µg/kg													
Hexachlorobutadiene	µg/kg													
Hexachlorocyclopentadiene	µg/kg													
Hexachloroethane	µg/kg													
Indeno(1,2,3-c,d)pyrene	µg/kg	<2400	<32000	<4700		2500	<6600	5900	<33000	5000	6700	<22000	<12000	<10500
Isophorone	µg/kg													
Naphthalene	µg/kg	<2400	<32000	<4700	460	1700	2900	29000	210000	6500	74000	120000	<12000	5300
Nitrobenzene	µg/kg													
N-nitrosodimethylamine	µg/kg													
N-nitrosodi-N-propylamine	µg/kg													
N-nitrosodiphenylamine	µg/kg													
Pentachlorophenol	µg/kg													

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	1 ROX2-90	1 ROX2-94	1 ROX2-95	1 UH 8.5	2 COL1-13	2 COL2-37	2 COL2-38	2 COL2-39	2 COL2-40	2 COL2-41	2 COL2-42	2 COL2-46	2 COL2-47
Phenanthrene	µg/kg	<2400	72000	1700	990	3200	13000	45000	220000	52000	110000	150000	9400	87000
Phenol (µg/kg units)	µg/kg	<2400	<32000	<4700	990		<6600	<10500	<33000	<8200	<16000	<22000	<12000	<10500
Phenol (mg/kg units)	mg/kg													
Pyrene	µg/kg	<2400	51000	<4700	2880	5100	9100	31000	130000	32000	70000	81000	9400	41000
Pyridine	µg/kg													
TIC	µg/kg													
Toluene-2,4-diamine	µg/kg													
Total HMW-PAHs (13 PAHs)	µg/kg	<14400	160000	<28200	24310	22100	30600	116150	358500	95100	214000	228000	40800	121250
Total HMW-PAHs***	µg/kg		144000		24310	19800	24000	110900	342000	91000	206000	217000	22800	116000
Total LMW-PAHs (13 PAHs)	µg/kg	<16800	148700	15800	1450	16100	33100	139950	969500	86300	382000	581000	45400	136950
Total LMW-PAHs***	µg/kg		84700	1700	1450	6900	19900	134700	953000	78100	374000	570000	9400	131700
Total PAHs (13 PAHs)	µg/kg	<31200	308700	29900	25760	38200	63700	256100	1328000	181400	596000	809000	86200	258200
Total PAHs***	µg/kg		228700	1700	25760	26700	43900	245600	1295000	169100	580000	787000	32200	247700
Unknown	µg/kg													
Polychorinated Biphenyls														
Aroclor 1016	µg/kg													
Aroclor 1221	µg/kg													
Aroclor 1232	µg/kg													
Aroclor 1242	µg/kg													
Aroclor 1248	µg/kg				1580									
Aroclor 1254	µg/kg													
Aroclor 1260	µg/kg													
Total PCBs	µg/kg				1580									
Total PCBs**	µg/kg													
Pesticides														
Aldrin	µg/kg													
Chlordane	µg/kg				1280									
Chlordane - alpha	µg/kg													
Chlordane - gamma	µg/kg													
Chlordane - reported*	µg/kg													
Dieldrin	µg/kg				240									
Dieldrin only (not Aldrin)	µg/kg													
Endosulfan sulfate	µg/kg													
Endosulfan-alpha	µg/kg													
Endosulfan-beta	µg/kg													
Endrin	µg/kg													
Endrin ketone	µg/kg													
Heptachlor	µg/kg				90									
Heptachlor + Hept. epox.**	µg/kg													
Heptachlor epoxide	µg/kg													
Hexachlorocyclohexane**	µg/kg													

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	1 ROX2-90	1 ROX2-94	1 ROX2-95	1 UH 8.5	2 COL1-13	2 COL2-37	2 COL2-38	2 COL2-39	2 COL2-40	2 COL2-41	2 COL2-42	2 COL2-46	2 COL2-47
Hexachlorocyclohexane-α	µg/kg													
Hexachlorocyclohexane-β	µg/kg													
Hexachlorocyclohexane-δ	µg/kg													
Lindane	µg/kg				270									
Methoxychlor	µg/kg													
o,p'-DDD	µg/kg													
o,p'-DDE	µg/kg													
o,p'-DDT	µg/kg													
p,p'-DDD	µg/kg				60									
p,p'-DDE	µg/kg				4360									
p,p'-DDT	µg/kg				1200									
Sum DDD	µg/kg				60									
Sum DDD**	µg/kg													
Sum DDE	µg/kg				4360									
Sum DDE**	µg/kg													
Sum DDT	µg/kg				1200									
Sum DDT**	µg/kg													
Total DDT	µg/kg				5620									
Total DDT**	µg/kg													
Total DDT***	µg/kg				5620									
Toxaphene	µg/kg				4370									
Dioxins														
2,3,7,8-Dibenzo-p-dioxin	µg/kg				<0.003									

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	2 MOL1-17	2 MOL2-48	2 MOL2-50	2 MOL2-52	2 MOL2-54	2 MOL2-56	2 MOL2-58	2 MOL2-59	2 MOL2-60	2 MOL2-61	2 MOL2-68	2 MOL2-70	2 ROX1-21A
Location														
Depth	feet	0-3	0-3	3-6	6-9	9-12	12-13	0-3	3-6	6-9	9-11.7	0-3	0-3	0-3
Latitude		41.6159	41.6159	41.6159	41.6159	41.6159	41.6159	41.6159	41.6159	41.6159	41.6159	41.61595	41.616	41.6163
Longitude		-87.4938	-87.4938	-87.4938	-87.4938	-87.4938	-87.4938	-87.4938	-87.4938	-87.4938	-87.4938	-87.4938	-87.4938	-87.4903
Conventionals														
Acid volatile sulfides	µmol/g													
Acid volatile sulfides	mg/kg													
Ammonia-nitrogen	mg/kg	987	1080	1580	1680	1350	355	1370	1600	1560	820	214	1830	672
% clay sized particles	%													
% gravel sized particles	%													
% sand + gravel sized prtcls	%													
% sand sized particles	%													
% silt + clay sized particles	%													
% silt sized particles	%													
Metals														
Aluminum	mg/kg	9800	9300	12000	12000	13000	3700	9200	13000	15000	6800	10000	11000	7900
Antimony	mg/kg	14	84	47	13	10	7	120	30	11	9	17	99	10
Arsenic	mg/kg	30	140	41	17	<11	<5.4	100	<13	18	<7.2	<11	180	35
Barium	mg/kg	200	410	190	130	110	30	480	160	120	60	170	590	140
Beryllium	mg/kg	0.8	1.2	1	0.7	0.6	0.3	1.3	1	0.8	0.5	0.7	1.5	0.7
Boron	mg/kg	<4												<4
Cadmium	mg/kg	21	82	14	8	<1.3	<0.7	75	9.9	3.2	<0.9	5.4	80	19
Calcium	mg/kg	29000	25000	31000	32000	27000	34000	20000	36000	25000	33000	44000	26000	33000
Chromium	mg/kg	170	890	110	29	20	9.4	900	44	25	11	65	560	210
Cobalt	mg/kg	10	14	12	13	11	5.4	17	13	12	8.4	12	14	11
Copper	mg/kg	240	550	310	140	27	8.4	560	250	79	13	160	710	150
Cyanide	mg/kg													
Iron	mg/kg	58000	250000	76000	40000	39000	12000	190000	45000	40000	20000	43000	260000	76000
Lead	mg/kg	640	1800	1200	510	24	<5.4	2600	1100	210	<7.2	1100	12000	780
Lithium	mg/kg	13	5	20	20	22	9.3	6.5	25	24	15	18	7.2	12
Magnesium	mg/kg	12000	5400	13000	14000	13000	18000	5600	15000	12000	14000	15000	5500	11000
Manganese	mg/kg	540	1700	810	580	900	330	1200	660	550	470	570	1700	940
Mercury	mg/kg													
Molybdenum	mg/kg	6	39	6.8	<2.3	2.4	1.3	30	3.7	2.5	1.3	2.7	29	5.6
Nickel	mg/kg	38	180	55	33	29	11	180	36	33	19	37	130	49
Potassium	mg/kg	940	<900	1300	1200	1600	500	<1000	1700	1700	850	1200	890	830
Selenium	mg/kg													
Silver	mg/kg	6	23	1.2	<0.9	<0.8	<0.4	25	<1	<0.9	<0.5	2.2	20	5.5
Sodium	mg/kg	330	650	300	270	310	170	550	310	330	250	510	630	610
Strontium	mg/kg	41	71	44	39	43	20	70	46	38	35	55	80	39
Thallium	mg/kg													

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	2 MOL1-17	2 MOL2-48	2 MOL2-50	2 MOL2-52	2 MOL2-54	2 MOL2-56	2 MOL2-58	2 MOL2-59	2 MOL2-60	2 MOL2-61	2 MOL2-68	2 MOL2-70	2 ROX1-21A
Tin	mg/kg	65	350	49	12	<5.2	<2.7	340	18	6.8	<3.6	34	290	80
Titanium	mg/kg	160	260	240	230	210	86	240	230	210	130	180	290	140
Vanadium	mg/kg	21	44	29	23	24	8.6	41	26	26	13	24	49	20
Zinc	mg/kg	3200	10000	3300	1600	98	34	9500	1800	750	52	1800	11000	2500
Volatile Organic Compounds														
1,2,4-Trichlorobenzene	µg/kg													
1,2-Dichlorobenzene	µg/kg													
1,3-Dichlorobenzene	µg/kg													
1,4-Dichlorobenzene	µg/kg													
Benzene	µg/kg	<120												57
Semi-Volatile Organic Compounds														
1,2,3,4-Tetrachlorobenzene	µg/kg													
1,2,3,5-Tetrachlorobenzene	µg/kg													
1,2-Dinitrobenzene	µg/kg													
1,2-Diphenylhydrazine	µg/kg													
1,3-Dinitrobenzene	µg/kg													
1,4-Dinitrobenzene	µg/kg													
2,2'-Oxybis(1-chloropropane)	µg/kg													
2,3,4,6-Tetrachlorophenol	µg/kg													
2,4,5-Trichlorophenol	µg/kg													
2,4,6-Trichlorophenol	µg/kg													
2,4-Dichlorophenol	µg/kg													
2,4-Dimethylphenol	µg/kg													
2,4-Dinitrophenol	µg/kg													
2,4-Dinitrotoluene	µg/kg													
2,6-Dinitrotoluene	µg/kg													
2-Chloronaphthalene	µg/kg													
2-Chlorophenol	µg/kg													
2-Methylnaphthalene	µg/kg	5400	15000	33000	3500	<5200	<2000	54000	3500	<3800	<3600	<54000	<2900	<11000
2-Methylphenol	µg/kg													
2-Nitroaniline	µg/kg													
2-Nitrophenol	µg/kg													
2-Picoline	µg/kg													
3,3'-Dichlorobenzidine	µg/kg													
3-Nitroaniline	µg/kg													
4,6-Dinitro-2-methylphenol	µg/kg													
4-Bromophenyl phenyl ether	µg/kg													
4-Chloro-3-methylphenol	µg/kg													
4-Chloroaniline	µg/kg													
4-Chlorophenyl phenyl ether	µg/kg													

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	2 MOL1-17	2 MOL2-48	2 MOL2-50	2 MOL2-52	2 MOL2-54	2 MOL2-56	2 MOL2-58	2 MOL2-59	2 MOL2-60	2 MOL2-61	2 MOL2-68	2 MOL2-70	2 ROX1-21A
4-Methylphenol	µg/kg													
4-Nitroaniline	µg/kg													
4-Nitrophenol	µg/kg													
Acenaphthene	µg/kg	21000	<18000	10000	<5200	<5200	<2000	<27000	1900	<3800	<3600	<54000	35000	4800
Acenaphthylene	µg/kg	<15000	<18000	<23000	<5200	<5200	<2000	<27000	<2500	<3800	<3600	<54000	<2900	<11000
Aniline	µg/kg													
Anthracene	µg/kg	15000	11000	17000	<5200	<5200	<2000	22000	2000	<3800	<3600	57000	50000	4000
Benzidine	µg/kg													
Benzo(a)anthracene	µg/kg	42000	56000	41000	5700	<5200	<2000	99000	4600	<3800	<3600	420000	190000	14000
Benzo(a)pyrene	µg/kg	31000	24000	22000	<5200	<5200	<2000	42000	2000	<3800	<3600	160000	73000	12000
Benzo(b)fluoranthene	µg/kg													
Benzo(g,h,i)perylene	µg/kg													
Benzo(k)fluoranthene	µg/kg	6900	<18000	<23000	<5200	<5200	<2000	<27000	<2500	<3800	<3600	<54000	6900	1800
Benzoic acid	µg/kg													
Benzyl alcohol	µg/kg													
Bis(2-chloroethoxy)methane	µg/kg													
Bis(2-chloroethyl)ether	µg/kg													
Bis(2-ethylhexyl)phthalate	µg/kg													
Butylbenzylphthalate	µg/kg													
Carbazole	µg/kg													
Chrysene	µg/kg	86000	120000	80000	9300	<5200	<2000	210000	9000	2500	<3600	730000	230000	31000
Dibenz(a,h)anthracene	µg/kg	<15000	<18000	<23000	<5200	<5200	<2000	<27000	<2500	<3800	<3600	26000	<2900	<11000
Dibenzofuran	µg/kg													
Diethylphthalate	µg/kg													
Dimethylphthalate	µg/kg													
Di-n-butyl phthalate	µg/kg													
Di-n-octylphthalate	µg/kg													
Fluoranthene	µg/kg	28000	38000	33000	4000	<5200	<2000	64000	3400	<3800	<3600	200000	130000	9300
Fluorene	µg/kg	14000	12000	19000	<5200	<5200	<2000	33000	2600	<3800	<3600	51000	69000	4700
Hexachlorobenzene	µg/kg													
Hexachlorobutadiene	µg/kg													
Hexachlorocyclopentadiene	µg/kg													
Hexachloroethane	µg/kg													
Indeno(1,2,3-c,d)pyrene	µg/kg	8600	<18000	<23000	<5200	<5200	<2000	<27000	<2500	<3800	<3600	26000	16000	<11000
Isophorone	µg/kg													
Naphthalene	µg/kg	<15000	<18000	<23000	3000	<5200	<2000	<27000	<2500	<3800	<3600	<54000	<2900	<11000
Nitrobenzene	µg/kg													
N-nitrosodimethylamine	µg/kg													
N-nitrosodi-N-propylamine	µg/kg													
N-nitrosodiphenylamine	µg/kg													
Pentachlorophenol	µg/kg													

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	2 MOL1-17	2 MOL2-48	2 MOL2-50	2 MOL2-52	2 MOL2-54	2 MOL2-56	2 MOL2-58	2 MOL2-59	2 MOL2-60	2 MOL2-61	2 MOL2-68	2 MOL2-70	2 ROX1-21A
Phenanthrene	µg/kg	6800	130000	190000	15000	2700	<2000	420000	19000	5400	1200	1070000	430000	<11000
Phenol (µg/kg units)	µg/kg		<18000	<23000	<5200	<5200	<2000	<27000	<2500	<3800	<3600	<54000	<29000	
Phenol (mg/kg units)	mg/kg													
Pyrene	µg/kg	78000	97000	82000	8900	<5200	<2000	180000	8300	2400	<3600	700000	250000	28000
Pyridine	µg/kg													
TIC	µg/kg													
Toluene-2,4-diamine	µg/kg													
Total HMW-PAHs (13 PAHs)	µg/kg	272500	344000	269500	33100	<31200	<12000	608500	28550	12500	<21600	2236000	874450	99800
Total HMW-PAHs***	µg/kg	265000	335000	258000	27900		<2000	595000	27300	4900		2236000	873000	94300
Total LMW-PAHs (13 PAHs)	µg/kg	77200	195000	292000	31900	18300	<14000	569500	31500	16800	12000	1286000	588350	35500
Total LMW-PAHs***	µg/kg	62200	168000	269000	21500	2700		529000	29000	5400	1200	1178000	584000	13500
Total PAHs (13 PAHs)	µg/kg	349700	539000	561500	65000	33900	<26000	1178000	60050	29300	22800	3522000	1462800	135300
Total PAHs***	µg/kg	327200	503000	527000	49400	2700	<2000	1124000	56300	10300	1200	3414000	1457000	107800
Unknown	µg/kg													
Polychorinated Biphenyls														
Aroclor 1016	µg/kg													
Aroclor 1221	µg/kg													
Aroclor 1232	µg/kg													
Aroclor 1242	µg/kg													
Aroclor 1248	µg/kg													
Aroclor 1254	µg/kg													
Aroclor 1260	µg/kg													
Total PCBs	µg/kg													
Total PCBs**	µg/kg													
Pesticides														
Aldrin	µg/kg													
Chlordane	µg/kg													
Chlordane - alpha	µg/kg													
Chlordane - gamma	µg/kg													
Chlordane - reported*	µg/kg													
Dieldrin	µg/kg													
Dieldrin only (not Aldrin)	µg/kg													
Endosulfan sulfate	µg/kg													
Endosulfan-alpha	µg/kg													
Endosulfan-beta	µg/kg													
Endrin	µg/kg													
Endrin ketone	µg/kg													
Heptachlor	µg/kg													
Heptachlor + Hept. epox.**	µg/kg													
Heptachlor epoxide	µg/kg													
Hexachlorocyclohexane**	µg/kg													

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	2 MOL1-17	2 MOL2-48	2 MOL2-50	2 MOL2-52	2 MOL2-54	2 MOL2-56	2 MOL2-58	2 MOL2-59	2 MOL2-60	2 MOL2-61	2 MOL2-68	2 MOL2-70	2 ROX1-21A
Hexachlorocyclohexane-α	µg/kg													
Hexachlorocyclohexane-β	µg/kg													
Hexachlorocyclohexane-δ	µg/kg													
Lindane	µg/kg													
Methoxychlor	µg/kg													
o,p'-DDD	µg/kg													
o,p'-DDE	µg/kg													
o,p'-DDT	µg/kg													
p,p'-DDD	µg/kg													
p,p'-DDE	µg/kg													
p,p'-DDT	µg/kg													
Sum DDD	µg/kg													
Sum DDD**	µg/kg													
Sum DDE	µg/kg													
Sum DDE**	µg/kg													
Sum DDT	µg/kg													
Sum DDT**	µg/kg													
Total DDT	µg/kg													
Total DDT**	µg/kg													
Total DDT***	µg/kg													
Toxaphene	µg/kg													
Dioxins														
2,3,7,8-Dibenzo-p-dioxin	µg/kg													

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	2 ROX1-21B	2 ROX2-71	2 ROX2-72	2 ROX2-73	2 ROX2-74	2 ROX2-75	2 ROX2-76	2 ROX2-80	2 ROX2-81	2 UG 9 all	2 UG-9	2 UG9 Bottom
Location													
Depth	feet	0-3	0-3	3-6	6-7.5	0-3	3-6	6-7.7	0-3	0-3	0-9	Surface	6-9
Latitude		41.6163	41.6163	41.6163	41.6163	41.6163	41.6163	41.6163	41.61617	41.6164	41.61632	41.61653	41.61653
Longitude		-87.4903	-87.4903	-87.4903	-87.4903	-87.4903	-87.4903	-87.4903	-87.4902	-87.4903	-87.49038	-87.48994	-87.48994
Conventionals													
Acid volatile sulfides	µmol/g											549.5	
Acid volatile sulfides	mg/kg											17620.267	
Ammonia-nitrogen	mg/kg	598	677	763	793	572	711	690	14	273			
% clay sized particles	%												
% gravel sized particles	%												
% sand + gravel sized prtcls	%												
% sand sized particles	%												
% silt + clay sized particles	%												
% silt sized particles	%												
Metals													
Aluminum	mg/kg	7000	11000	11000	12000	10000	9100	10000	3100	7200			
Antimony	mg/kg	18	49	77	32	35	95	17	9	36			
Arsenic	mg/kg	43	76	97	16	41	95	18	8.3	30			
Barium	mg/kg	160	220	250	98	160	220	93	87	160			
Beryllium	mg/kg	0.7	1	1.1	0.8	0.8	1.2	0.6	0.3	0.7			
Boron	mg/kg	<4											
Cadmium	mg/kg	22	38	29	3.3	24	32	1.6	7.2	20		52	
Calcium	mg/kg	28000	28000	22000	26000	34000	21000	28000	8000	26000			
Chromium	mg/kg	240	440	180	23	320	100	18	140	240		904	
Cobalt	mg/kg	9.7	18	12	11	11	12	10	4	9.3			
Copper	mg/kg	180	250	520	82	180	560	59	71	200		544	
Cyanide	mg/kg												
Iron	mg/kg	87000	150000	200000	66000	120000	170000	61000	25000	78000		6940	
Lead	mg/kg	740	1300	4100	190	900	2600	140	380	1500		1916	
Lithium	mg/kg	9.3	14	12	22	15	12	17	3.5	9.1			
Magnesium	mg/kg	9300	9600	7200	10000	13000	7300	9600	3100	9200		4930	
Manganese	mg/kg	900	1400	1400	670	1300	1400	730	190	710		1679	
Mercury	mg/kg												
Molybdenum	mg/kg	8	13	11	3.2	7.8	11	<2.2	2.9	6.9			
Nickel	mg/kg	57	160	57	29	74	55	24	26	54		361	
Potassium	mg/kg	620	1100	920	1300	1200	<700	960	240	570			
Selenium	mg/kg												
Silver	mg/kg	6.2	9.3	5.5	<0.8	6	1.7	<0.9	3.7	6.5			
Sodium	mg/kg	660	770	1100	1000	710	1100	920	170	460			
Strontium	mg/kg	40	45	41	36	43	39	39	14	37			
Thallium	mg/kg												

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	2 ROX1-21B	2 ROX2-71	2 ROX2-72	2 ROX2-73	2 ROX2-74	2 ROX2-75	2 ROX2-76	2 ROX2-80	2 ROX2-81	2 UG 9 all	2 UG-9	2 UG9 Bottom
Tin	mg/kg	100	160	110	<5.3	120	98	<6	59	120			
Titanium	mg/kg	140	230	240	180	210	220	170	75	160			
Vanadium	mg/kg	19	32	35	22	28	32	19	8.8	21			
Zinc	mg/kg	2700	5100	6800	800	3300	6400	600	880	3200		450	
Volatile Organic Compounds													
1,2,4-Trichlorobenzene	µg/kg												
1,2-Dichlorobenzene	µg/kg												
1,3-Dichlorobenzene	µg/kg												
1,4-Dichlorobenzene	µg/kg												
Benzene	µg/kg	<160											
Semi-Volatile Organic Compounds													
1,2,3,4-Tetrachlorobenzene	µg/kg												
1,2,3,5-Tetrachlorobenzene	µg/kg												
1,2-Dinitrobenzene	µg/kg												
1,2-Diphenylhydrazine	µg/kg												
1,3-Dinitrobenzene	µg/kg												
1,4-Dinitrobenzene	µg/kg												
2,2'-Oxybis(1-chloropropane)	µg/kg												
2,3,4,6-Tetrachlorophenol	µg/kg												
2,4,5-Trichlorophenol	µg/kg												
2,4,6-Trichlorophenol	µg/kg												
2,4-Dichlorophenol	µg/kg												
2,4-Dimethylphenol	µg/kg												
2,4-Dinitrophenol	µg/kg												
2,4-Dinitrotoluene	µg/kg												
2,6-Dinitrotoluene	µg/kg												
2-Chloronaphthalene	µg/kg												
2-Chlorophenol	µg/kg												
2-Methylnaphthalene	µg/kg	1500	<16000	<21000	2600	<5500	<7400	<5300	21000	2900			
2-Methylphenol	µg/kg												
2-Nitroaniline	µg/kg												
2-Nitrophenol	µg/kg												
2-Picoline	µg/kg												
3,3'-Dichlorobenzidine	µg/kg												
3-Nitroaniline	µg/kg												
4,6-Dinitro-2-methylphenol	µg/kg												
4-Bromophenyl phenyl ether	µg/kg												
4-Chloro-3-methylphenol	µg/kg												
4-Chloroaniline	µg/kg												
4-Chlorophenyl phenyl ether	µg/kg												

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	2 ROX1-21B	2 ROX2-71	2 ROX2-72	2 ROX2-73	2 ROX2-74	2 ROX2-75	2 ROX2-76	2 ROX2-80	2 ROX2-81	2 UG 9 all	2 UG-9	2 UG9 Bottom
4-Methylphenol	µg/kg												
4-Nitroaniline	µg/kg												
4-Nitrophenol	µg/kg												
Acenaphthene	µg/kg	4000	12000	34000	3300	8700	15000	<5300	<2100	3800			
Acenaphthylene	µg/kg	<4600	<16000	<21000	<4700	<5500	<7400	<5300	<2100	<5800			
Aniline	µg/kg												
Anthracene	µg/kg	6200	18000	29000	2600	13000	17000	<5300	1000	6500			
Benzidine	µg/kg												
Benzo(a)anthracene	µg/kg	25000	70000	44000	4200	35000	30000	<5300	6900	17000		1650	16200
Benzo(a)pyrene	µg/kg	13000	31000	24000	2500	24000	17000	<5300	5300	10100	<240	100210	3300
Benzo(b)fluoranthene	µg/kg												
Benzo(g,h,i)perylene	µg/kg												
Benzo(k)fluoranthene	µg/kg	1900	<16000	<21000	<4700	<5500	<7400	<5300	<2100	1400		2180	5700
Benzoic acid	µg/kg												
Benzyl alcohol	µg/kg												
Bis(2-chloroethoxy)methane	µg/kg												
Bis(2-chloroethyl)ether	µg/kg												
Bis(2-ethylhexyl)phthalate	µg/kg												
Butylbenzylphthalate	µg/kg												
Carbazole	µg/kg												
Chrysene	µg/kg	56000	150000	84000	8100	46000	53000	<5300	16000	35000		5210	9000
Dibenz(a,h)anthracene	µg/kg	1900	<16000	<21000	<4700	4000	<7400	<5300	700	<5800			
Dibenzofuran	µg/kg												
Diethylphthalate	µg/kg												
Dimethylphthalate	µg/kg												
Di-n-butyl phthalate	µg/kg												
Di-n-octylphthalate	µg/kg												
Fluoranthene	µg/kg	19000	48000	48000	4000	27000	27000	<5300	5600	15000		310	32100
Fluorene	µg/kg	7800	29000	36000	3500	20000	24000	<5300	<2100	8600			
Hexachlorobenzene	µg/kg												
Hexachlorobutadiene	µg/kg												
Hexachlorocyclopentadiene	µg/kg												
Hexachloroethane	µg/kg												
Indeno(1,2,3-c,d)pyrene	µg/kg	2700	<16000	<21000	<4700	4900	3900	<5300	1000	1900			
Isophorone	µg/kg												
Naphthalene	µg/kg	<4600	<16000	<21000	<4700	<5500	5300	<5300	<2000.1	<5800		3580	24460
Nitrobenzene	µg/kg												
N-nitrosodimethylamine	µg/kg												
N-nitrosodi-N-propylamine	µg/kg												
N-nitrosodiphenylamine	µg/kg												
Pentachlorophenol	µg/kg												

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	2 ROX1-21B	2 ROX2-71	2 ROX2-72	2 ROX2-73	2 ROX2-74	2 ROX2-75	2 ROX2-76	2 ROX2-80	2 ROX2-81	2 UG 9 all	2 UG-9	2 UG9 Bottom
Phenanthrene	µg/kg	6300	71000	170000	20000	10400	120000	1800	2000	48000		4040	245400
Phenol (µg/kg units)	µg/kg		<16000	<21000	<4700	<5500	<7400	<5300	<2100	<5800		70	20
Phenol (mg/kg units)	mg/kg												
Pyrene	µg/kg	52000	130000	99000	9800	70000	67000	<5300	18000	44000		4570	19800
Pyridine	µg/kg												
TIC	µg/kg												
Toluene-2,4-diamine	µg/kg												
Total HMW-PAHs (13 PAHs)	µg/kg	166900	437000	309500	30950	206000	197700	<31800	52500	124000	<240	111950	80400
Total HMW-PAHs***	µg/kg	166900	429000	299000	28600	206000	194000		52500	121100	<240	111950	80400
Total LMW-PAHs (13 PAHs)	µg/kg	30400	154000	300500	36700	60350	188700	17700	28150.04999	75600		7620	269860
Total LMW-PAHs***	µg/kg	25800	130000	269000	32000	52100	181300	1800	24000	69800		7620	269860
Total PAHs (13 PAHs)	µg/kg	197300	591000	610000	67650	266350	386400	33600	80650.04999	199600	<240	119570	350260
Total PAHs***	µg/kg	192700	559000	568000	60600	258100	375300	1800	76500	190900	<240	119570	350260
Unknown	µg/kg												
Polychorinated Biphenyls													
Aroclor 1016	µg/kg												
Aroclor 1221	µg/kg												
Aroclor 1232	µg/kg												
Aroclor 1242	µg/kg												
Aroclor 1248	µg/kg											4610	ND
Aroclor 1254	µg/kg												
Aroclor 1260	µg/kg												
Total PCBs	µg/kg										<490	4610	ND
Total PCBs**	µg/kg											4610	
Pesticides													
Aldrin	µg/kg												
Chlordane	µg/kg										<0.5	2180	5270
Chlordane - alpha	µg/kg												
Chlordane - gamma	µg/kg												
Chlordane - reported*	µg/kg											2180	
Dieldrin	µg/kg										<0.5	3210	10880
Dieldrin only (not Aldrin)	µg/kg											3210	
Endosulfan sulfate	µg/kg												
Endosulfan-alpha	µg/kg												
Endosulfan-beta	µg/kg												
Endrin	µg/kg												
Endrin ketone	µg/kg												
Heptachlor	µg/kg										<0.5	1720	3290
Heptachlor + Hept. epox.**	µg/kg											1720	
Heptachlor epoxide	µg/kg												
Hexachlorocyclohexane**	µg/kg											3160	

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	2 ROX1-21B	2 ROX2-71	2 ROX2-72	2 ROX2-73	2 ROX2-74	2 ROX2-75	2 ROX2-76	2 ROX2-80	2 ROX2-81	2 UG 9 all	2 UG-9	2 UG9 Bottom
Hexachlorocyclohexane-α	µg/kg												
Hexachlorocyclohexane-β	µg/kg												
Hexachlorocyclohexane-δ	µg/kg												
Lindane	µg/kg										<0.5	3160	4160
Methoxychlor	µg/kg												
o,p'-DDD	µg/kg												
o,p'-DDE	µg/kg												
o,p'-DDT	µg/kg												
p,p'-DDD	µg/kg											10	ND
p,p'-DDE	µg/kg											4650	4220
p,p'-DDT	µg/kg											1750	990
Sum DDD	µg/kg												
Sum DDD**	µg/kg											10	
Sum DDE	µg/kg												
Sum DDE**	µg/kg											4650	
Sum DDT	µg/kg												
Sum DDT**	µg/kg											1750	
Total DDT	µg/kg										<1.4	6410	5210
Total DDT**	µg/kg											6410	
Total DDT***	µg/kg										<1.4	6410	5210
Toxaphene	µg/kg										<0.5	3320	5220
Dioxins													
2,3,7,8-Dibenzo-p-dioxin	µg/kg											0.0000073	

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	2 UG9 Middle	2 UG9 Top	2 UG9/1.1	2 UG9/12.1	2 UG9/5.9	2 UG9-A	2 UG9-B	2 UG9-C	2 UH9.1	2 UH9.15/0.9	2 UH9.15/12.1	2 UH9.15/5.5
Location													
Depth	feet	3-6	0-3	1-1.1	12-12.2	5.7-6	0-3	3-6	6-9	0-9	0.8-1	12-12.1	5.4-5.5
Latitude		41.61653	41.61653	41.61632	41.61632	41.61632	41.6162	41.6162	41.6162	41.6172	41.61878	41.61878	41.61878
Longitude		-87.48994	-87.48994	-87.49038	-87.49038	-87.49038	-87.4902	-87.4902	-87.4902	-87.4973	-87.49957	-87.49957	-87.49957
Conventionals													
Acid volatile sulfides	µmol/g												
Acid volatile sulfides	mg/kg												
Ammonia-nitrogen	mg/kg												
% clay sized particles	%		0.05										
% gravel sized particles	%												
% sand + gravel sized prtcls	%		71.42										
% sand sized particles	%												
% silt + clay sized particles	%												
% silt sized particles	%		28.53										
Metals													
Aluminum	mg/kg												
Antimony	mg/kg												
Arsenic	mg/kg												
Barium	mg/kg												
Beryllium	mg/kg												
Boron	mg/kg												
Cadmium	mg/kg			80.4	<1.5	<1.5	48	15	3	18	<1.5	3.1	27.4
Calcium	mg/kg												
Chromium	mg/kg						592	360	196	362			
Cobalt	mg/kg												
Copper	mg/kg			496	<4	28	549	235	39	182	147	325	462
Cyanide	mg/kg												
Iron	mg/kg						115300	59300	65900	63400			
Lead	mg/kg			1550	30	250	2450	1780	99	1160	250	410	7020
Lithium	mg/kg												
Magnesium	mg/kg						3626	7286	9826	11835			
Manganese	mg/kg						1180	752	825	864			
Mercury	mg/kg												
Molybdenum	mg/kg												
Nickel	mg/kg			160	<20	<20	428	41	78	94	<20	<20	<10
Potassium	mg/kg												
Selenium	mg/kg												
Silver	mg/kg												
Sodium	mg/kg												
Strontium	mg/kg												
Thallium	mg/kg												

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	2 UG9 Middle	2 UG9 Top	2 UG9/1.1	2 UG9/12.1	2 UG9/5.9	2 UG9-A	2 UG9-B	2 UG9-C	2 UH9.1	2 UH9.15/0.9	2 UH9.15/12.1	2 UH9.15/5.5
Tin	mg/kg												
Titanium	mg/kg												
Vanadium	mg/kg												
Zinc	mg/kg			8130	17	371	5500	3690	145	4140	337	2870	5700
Volatile Organic Compounds													
1,2,4-Trichlorobenzene	µg/kg												
1,2-Dichlorobenzene	µg/kg												
1,3-Dichlorobenzene	µg/kg												
1,4-Dichlorobenzene	µg/kg												
Benzene	µg/kg												
Semi-Volatile Organic Compounds													
1,2,3,4-Tetrachlorobenzene	µg/kg												
1,2,3,5-Tetrachlorobenzene	µg/kg												
1,2-Dinitrobenzene	µg/kg												
1,2-Diphenylhydrazine	µg/kg												
1,3-Dinitrobenzene	µg/kg												
1,4-Dinitrobenzene	µg/kg												
2,2'-Oxybis(1-chloropropane)	µg/kg												
2,3,4,6-Tetrachlorophenol	µg/kg												
2,4,5-Trichlorophenol	µg/kg												
2,4,6-Trichlorophenol	µg/kg												
2,4-Dichlorophenol	µg/kg												
2,4-Dimethylphenol	µg/kg												
2,4-Dinitrophenol	µg/kg												
2,4-Dinitrotoluene	µg/kg												
2,6-Dinitrotoluene	µg/kg												
2-Chloronaphthalene	µg/kg												
2-Chlorophenol	µg/kg												
2-Methylnaphthalene	µg/kg												
2-Methylphenol	µg/kg												
2-Nitroaniline	µg/kg												
2-Nitrophenol	µg/kg												
2-Picoline	µg/kg												
3,3'-Dichlorobenzidine	µg/kg												
3-Nitroaniline	µg/kg												
4,6-Dinitro-2-methylphenol	µg/kg												
4-Bromophenyl phenyl ether	µg/kg												
4-Chloro-3-methylphenol	µg/kg												
4-Chloroaniline	µg/kg												
4-Chlorophenyl phenyl ether	µg/kg												

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	2 UG9 Middle	2 UG9 Top	2 UG9/1.1	2 UG9/12.1	2 UG9/5.9	2 UG9-A	2 UG9-B	2 UG9-C	2 UH9.1	2 UH9.15/0.9	2 UH9.15/12.1	2 UH9.15/5.5
4-Methylphenol	µg/kg												
4-Nitroaniline	µg/kg												
4-Nitrophenol	µg/kg												
Acenaphthene	µg/kg												
Acenaphthylene	µg/kg												
Aniline	µg/kg												
Anthracene	µg/kg												
Benzidine	µg/kg												
Benzo(a)anthracene	µg/kg	ND	ND										
Benzo(a)pyrene	µg/kg	216400	206300				206000	216000	167000	77300			
Benzo(b)fluoranthene	µg/kg												
Benzo(g,h,i)perylene	µg/kg												
Benzo(k)fluoranthene	µg/kg	ND	ND										
Benzoic acid	µg/kg												
Benzyl alcohol	µg/kg												
Bis(2-chloroethoxy)methane	µg/kg												
Bis(2-chloroethyl)ether	µg/kg												
Bis(2-ethylhexyl)phthalate	µg/kg												
Butylbenzylphthalate	µg/kg												
Carbazole	µg/kg												
Chrysene	µg/kg	ND	ND										
Dibenz(a,h)anthracene	µg/kg												
Dibenzofuran	µg/kg												
Diethylphthalate	µg/kg												
Dimethylphthalate	µg/kg												
Di-n-butyl phthalate	µg/kg												
Di-n-octylphthalate	µg/kg												
Fluoranthene	µg/kg	50	1280				1280	50	<10	3920			
Fluorene	µg/kg												
Hexachlorobenzene	µg/kg												
Hexachlorobutadiene	µg/kg												
Hexachlorocyclopentadiene	µg/kg												
Hexachloroethane	µg/kg												
Indeno(1,2,3-c,d)pyrene	µg/kg												
Isophorone	µg/kg												
Naphthalene	µg/kg	10270	1880				1880	10300	24500	4670			
Nitrobenzene	µg/kg												
N-nitrosodimethylamine	µg/kg												
N-nitrosodi-N-propylamine	µg/kg												
N-nitrosodiphenylamine	µg/kg												
Pentachlorophenol	µg/kg												

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	2 UG9 Middle	2 UG9 Top	2 UG9/1.1	2 UG9/12.1	2 UG9/5.9	2 UG9-A	2 UG9-B	2 UG9-C	2 UH9.1	2 UH9.15/0.9	2 UH9.15/12.1	2 UH9.15/5.5
Phenanthrene	µg/kg	14270	6370				6370	14300	4170	4880			
Phenol (µg/kg units)	µg/kg	380	2020				2020	380	20	410			
Phenol (mg/kg units)	mg/kg												
Pyrene	µg/kg	14270	10860				10900	14300	12000	5270			
Pyridine	µg/kg												
TIC	µg/kg												
Toluene-2,4-diamine	µg/kg												
Total HMW-PAHs (13 PAHs)	µg/kg	230720	218440				218180	230350	179005	86490			
Total HMW-PAHs***	µg/kg	230720	218440				218180	230350	179005	86490			
Total LMW-PAHs (13 PAHs)	µg/kg	24540	8250				8250	24600	28670	9550			
Total LMW-PAHs***	µg/kg	24540	8250				8250	24600	28670	9550			
Total PAHs (13 PAHs)	µg/kg	255260	226690				226430	254950	207675	96040			
Total PAHs***	µg/kg	255260	226690				226430	254950	207675	96040			
Unknown	µg/kg												
Polychorinated Biphenyls													
Aroclor 1016	µg/kg												
Aroclor 1221	µg/kg												
Aroclor 1232	µg/kg												
Aroclor 1242	µg/kg												
Aroclor 1248	µg/kg	20050	10400				10400	20100	<20	12800			
Aroclor 1254	µg/kg												
Aroclor 1260	µg/kg												
Total PCBs	µg/kg	20050	10400				10400	20100	<20	12800			
Total PCBs**	µg/kg												
Pesticides													
Aldrin	µg/kg												
Chlordane	µg/kg	1640	2350				2350	1640	5270	2060			
Chlordane - alpha	µg/kg												
Chlordane - gamma	µg/kg												
Chlordane - reported*	µg/kg												
Dieldrin	µg/kg	3180	4250				4250	3180	10900	8650			
Dieldrin only (not Aldrin)	µg/kg												
Endosulfan sulfate	µg/kg												
Endosulfan-alpha	µg/kg												
Endosulfan-beta	µg/kg												
Endrin	µg/kg												
Endrin ketone	µg/kg												
Heptachlor	µg/kg	10520	4610				4610	10520	3290	3940			
Heptachlor + Hept. epox.**	µg/kg												
Heptachlor epoxide	µg/kg												
Hexachlorocyclohexane**	µg/kg												

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	2 UG9 Middle	2 UG9 Top	2 UG9/1.1	2 UG9/12.1	2 UG9/5.9	2 UG9-A	2 UG9-B	2 UG9-C	2 UH9.1	2 UH9.15/0.9	2 UH9.15/12.1	2 UH9.15/5.5
Hexachlorocyclohexane-α	µg/kg												
Hexachlorocyclohexane-β	µg/kg												
Hexachlorocyclohexane-δ	µg/kg												
Lindane	µg/kg	1290	1760				1760	1290	4160	990			
Methoxychlor	µg/kg												
o,p'-DDD	µg/kg												
o,p'-DDE	µg/kg												
o,p'-DDT	µg/kg												
p,p'-DDD	µg/kg	680	130										
p,p'-DDE	µg/kg	11340	8840										
p,p'-DDT	µg/kg	1870	1330										
Sum DDD	µg/kg												
Sum DDD**	µg/kg												
Sum DDE	µg/kg												
Sum DDE**	µg/kg												
Sum DDT	µg/kg												
Sum DDT**	µg/kg												
Total DDT	µg/kg	13890	10300				10300	19970	5215	12960			
Total DDT**	µg/kg												
Total DDT***	µg/kg	13890	10300				10300	19970	5215	12960			
Toxaphene	µg/kg	11270	6350				6350	11270	5220	7510			
Dioxins													
2,3,7,8-Dibenzo-p-dioxin	µg/kg						0.0061	<0.003	<0.003	<0.004			

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	3 UH 9.2 all	3 UH9.2	3 UH9.2/1.1	3 UH9.2/12	3 UH9.2/5.9	4 SOHL1-09	4 SOHL2-21	4 SOHL2-23	4 SOHL2-25	4 SOHL2-27	4 SOHL2-28	4 SOHL2-29
Location													
Depth	feet	0-9	0-9	1-1.1	11.9-12.1	5.7-6	0-3	0-3	3-6	6-6.5	0-3	3-6	6-7
Latitude		41.61892	41.6189	41.61892	41.61892	41.61892	41.6222	41.6222	41.6222	41.6222	41.6222	41.6222	41.6222
Longitude		-87.50063	-87.5002	-87.50063	-87.50063	-87.50063	-87.5127	-87.5127	-87.5127	-87.5127	-87.5127	-87.5127	-87.5127
Conventionals													
Acid volatile sulfides	µmol/g												
Acid volatile sulfides	mg/kg												
Ammonia-nitrogen	mg/kg						288	581	1050	938	647	1120	623
% clay sized particles	%												
% gravel sized particles	%												
% sand + gravel sized prtcls	%												
% sand sized particles	%												
% silt + clay sized particles	%												
% silt sized particles	%												
Metals													
Aluminum	mg/kg						3400	7100	13000	15000	6400	14000	10000
Antimony	mg/kg						280	28	11	12	32	8	8
Arsenic	mg/kg						<4	38	32	13	26	<12	<10
Barium	mg/kg						110	280	140	120	290	110	90
Beryllium	mg/kg						0.5	0.6	0.7	0.7	0.5	0.7	0.7
Boron	mg/kg						<4	19	21	27	15	34	17
Cadmium	mg/kg		7	12.7	<1.5	9.1	1.9	12	4.6	3.4	14	2.2	2.1
Calcium	mg/kg						27000	22000	28000	26000	25000	24000	26000
Chromium	mg/kg		184				50	160	32	25	200	30	20
Cobalt	mg/kg						3.5	11	12	14	8.2	12	9.8
Copper	mg/kg		304	1000	29	335	140	410	330	180	380	130	77
Cyanide	mg/kg												
Iron	mg/kg		32600				15000	64000	35000	35000	48000	31000	27000
Lead	mg/kg		780	1440	40	760	180	970	330	170	570	110	67
Lithium	mg/kg						3	7.6	19	23	7.8	23	18
Magnesium	mg/kg		6691				9400	8800	15000	14000	10000	13000	14000
Manganese	mg/kg		382				330	400	330	370	440	340	420
Mercury	mg/kg												
Molybdenum	mg/kg						3.2	8	3.5	3.3	6	<2.2	2.9
Nickel	mg/kg		111	160	<20	30	19	100	32	30	64	30	28
Potassium	mg/kg						220	630	1400	1700	<800	1700	1200
Selenium	mg/kg												
Silver	mg/kg						2.2	5.9	<1	<0.9	6.5	<0.9	<0.8
Sodium	mg/kg						220	270	330	290	410	360	220
Strontium	mg/kg						32	51	45	48	45	40	44
Thallium	mg/kg												

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	3 UH 9.2 all	3 UH9.2	3 UH9.2/1.1	3 UH9.2/12	3 UH9.2/5.9	4 SOHL1-09	4 SOHL2-21	4 SOHL2-23	4 SOHL2-25	4 SOHL2-27	4 SOHL2-28	4 SOHL2-29
Tin	mg/kg						15	72	21	15	71	12	6.3
Titanium	mg/kg						110	170	230	240	160	220	170
Vanadium	mg/kg						12	22	25	27	19	26	19
Zinc	mg/kg		1330	2590	97	3230	420	3500	1300	1000	2300	530	350
Volatile Organic Compounds													
1,2,4-Trichlorobenzene	µg/kg												
1,2-Dichlorobenzene	µg/kg												
1,3-Dichlorobenzene	µg/kg												
1,4-Dichlorobenzene	µg/kg												
Benzene	µg/kg						16						
Semi-Volatile Organic Compounds													
1,2,3,4-Tetrachlorobenzene	µg/kg												
1,2,3,5-Tetrachlorobenzene	µg/kg												
1,2-Dinitrobenzene	µg/kg												
1,2-Diphenylhydrazine	µg/kg												
1,3-Dinitrobenzene	µg/kg												
1,4-Dinitrobenzene	µg/kg												
2,2'-Oxybis(1-chloropropane)	µg/kg												
2,3,4,6-Tetrachlorophenol	µg/kg												
2,4,5-Trichlorophenol	µg/kg												
2,4,6-Trichlorophenol	µg/kg												
2,4-Dichlorophenol	µg/kg												
2,4-Dimethylphenol	µg/kg												
2,4-Dinitrophenol	µg/kg												
2,4-Dinitrotoluene	µg/kg												
2,6-Dinitrotoluene	µg/kg												
2-Chloronaphthalene	µg/kg												
2-Chlorophenol	µg/kg												
2-Methylnaphthalene	µg/kg						4100	2000000	930000	56000	790000	220000	19000
2-Methylphenol	µg/kg												
2-Nitroaniline	µg/kg												
2-Nitrophenol	µg/kg												
2-Picoline	µg/kg												
3,3'-Dichlorobenzidine	µg/kg												
3-Nitroaniline	µg/kg												
4,6-Dinitro-2-methylphenol	µg/kg												
4-Bromophenyl phenyl ether	µg/kg												
4-Chloro-3-methylphenol	µg/kg												
4-Chloroaniline	µg/kg												
4-Chlorophenyl phenyl ether	µg/kg												

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	3 UH 9.2 all	3 UH9.2	3 UH9.2/1.1	3 UH9.2/12	3 UH9.2/5.9	4 SOHL1-09	4 SOHL2-21	4 SOHL2-23	4 SOHL2-25	4 SOHL2-27	4 SOHL2-28	4 SOHL2-29
4-Methylphenol	µg/kg												
4-Nitroaniline	µg/kg												
4-Nitrophenol	µg/kg												
Acenaphthene	µg/kg						7200	1300000	440000	38000	520000	140000	13000
Acenaphthylene	µg/kg						<81000	35000	<51000	<12000	<4600	<40000	<6000
Aniline	µg/kg												
Anthracene	µg/kg						4400	320000	170000	15000	170000	62000	5100
Benzidine	µg/kg												
Benzo(a)anthracene	µg/kg						19000	170000	83000	12000	97000	32000	3700
Benzo(a)pyrene	µg/kg	<20	114000				22000	98000	46000	6100	44000	<40000	<6000
Benzo(b)fluoranthene	µg/kg												
Benzo(g,h,i)perylene	µg/kg												
Benzo(k)fluoranthene	µg/kg						9300	27000	<51000	<12000	<46000	<40000	<6000
Benzoic acid	µg/kg												
Benzyl alcohol	µg/kg												
Bis(2-chloroethoxy)methane	µg/kg												
Bis(2-chloroethyl)ether	µg/kg												
Bis(2-ethylhexyl)phthalate	µg/kg												
Butylbenzylphthalate	µg/kg												
Carbazole	µg/kg												
Chrysene	µg/kg						21000	190000	86000	10900	96000	33000	3600
Dibenz(a,h)anthracene	µg/kg						3300	<7700	<51000	<12000	<46000	<40000	<6000
Dibenzofuran	µg/kg												
Diethylphthalate	µg/kg												
Dimethylphthalate	µg/kg												
Di-n-butyl phthalate	µg/kg												
Di-n-octylphthalate	µg/kg												
Fluoranthene	µg/kg		12600				34000	270000	150000	17000	150000	56000	5100
Fluorene	µg/kg						3100	400000	180000	15000	200000	59000	5100
Hexachlorobenzene	µg/kg												
Hexachlorobutadiene	µg/kg												
Hexachlorocyclopentadiene	µg/kg												
Hexachloroethane	µg/kg												
Indeno(1,2,3-c,d)pyrene	µg/kg						16000	43000	<51000	<12000	<46000	<40000	<6000
Isophorone	µg/kg												
Naphthalene	µg/kg		1260				4800	2900000	1400000	73000	1100000	310000	23000
Nitrobenzene	µg/kg												
N-nitrosodimethylamine	µg/kg												
N-nitrosodi-N-propylamine	µg/kg												
N-nitrosodiphenylamine	µg/kg												
Pentachlorophenol	µg/kg												

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	3 UH 9.2 all	3 UH9.2	3 UH9.2/1.1	3 UH9.2/12	3 UH9.2/5.9	4 SOHL1-09	4 SOHL2-21	4 SOHL2-23	4 SOHL2-25	4 SOHL2-27	4 SOHL2-28	4 SOHL2-29
Phenanthrene	µg/kg		13100				22000	1400000	690000	53000	570000	200000	19000
Phenol (µg/kg units)	µg/kg		70					<77000	<51000	<12000	<46000	<40000	<6000
Phenol (mg/kg units)	mg/kg												
Pyrene	µg/kg		1840				28000	410000	230000	25000	240000	86000	8100
Pyridine	µg/kg												
TIC	µg/kg												
Toluene-2,4-diamine	µg/kg												
Total HMW-PAHs (13 PAHs)	µg/kg	<20	128440				127300	1141850	620500	77000	650000	247000	26500
Total HMW-PAHs***	µg/kg	<20	128440				127300	1138000	595000	71000	627000	207000	20500
Total LMW-PAHs (13 PAHs)	µg/kg		14360				86100	8355000	3835500	256000	3352300	1011000	87200
Total LMW-PAHs***	µg/kg		14360				45600	8355000	3810000	250000	3350000	991000	84200
Total PAHs (13 PAHs)	µg/kg	<20	142800				213400	9496850	4456000	333000	4002300	1258000	113700
Total PAHs***	µg/kg	<20	142800				172900	9493000	4405000	321000	3977000	1198000	104700
Unknown	µg/kg												
Polychorinated Biphenyls													
Aroclor 1016	µg/kg												
Aroclor 1221	µg/kg												
Aroclor 1232	µg/kg												
Aroclor 1242	µg/kg												
Aroclor 1248	µg/kg		8470										
Aroclor 1254	µg/kg												
Aroclor 1260	µg/kg												
Total PCBs	µg/kg	350	8470										
Total PCBs**	µg/kg												
Pesticides													
Aldrin	µg/kg												
Chlordane	µg/kg	<0.4	1980										
Chlordane - alpha	µg/kg												
Chlordane - gamma	µg/kg												
Chlordane - reported*	µg/kg												
Dieldrin	µg/kg	<0.4	5290										
Dieldrin only (not Aldrin)	µg/kg												
Endosulfan sulfate	µg/kg												
Endosulfan-alpha	µg/kg												
Endosulfan-beta	µg/kg												
Endrin	µg/kg												
Endrin ketone	µg/kg												
Heptachlor	µg/kg	<0.4	350										
Heptachlor + Hept. epox.**	µg/kg												
Heptachlor epoxide	µg/kg												
Hexachlorocyclohexane**	µg/kg												

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	3 UH 9.2 all	3 UH9.2	3 UH9.2/1.1	3 UH9.2/12	3 UH9.2/5.9	4 SOHL1-09	4 SOHL2-21	4 SOHL2-23	4 SOHL2-25	4 SOHL2-27	4 SOHL2-28	4 SOHL2-29
Hexachlorocyclohexane-α	µg/kg												
Hexachlorocyclohexane-β	µg/kg												
Hexachlorocyclohexane-δ	µg/kg												
Lindane	µg/kg	<0.4	470										
Methoxychlor	µg/kg												
o,p'-DDD	µg/kg												
o,p'-DDE	µg/kg												
o,p'-DDT	µg/kg												
p,p'-DDD	µg/kg												
p,p'-DDE	µg/kg												
p,p'-DDT	µg/kg												
Sum DDD	µg/kg												
Sum DDD**	µg/kg												
Sum DDE	µg/kg												
Sum DDE**	µg/kg												
Sum DDT	µg/kg												
Sum DDT**	µg/kg												
Total DDT	µg/kg	7.6	16460										
Total DDT**	µg/kg												
Total DDT***	µg/kg	7.6	16460										
Toxaphene	µg/kg	<0.4	3880										
Dioxins													
2,3,7,8-Dibenzo-p-dioxin	µg/kg		<0.002										

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	4 SOHL2-33	4 SOHL2-35	4 SOHL2-96	4 UH9.3	5 SD-1	5 SD-1D	5 SD-98-25/0-2'	5 SD-98-25/2-5'	5 SD-98-26/0-2'	5 SD-98-26/2-5'	5 UH 9.4 all
Location												
Depth	feet	0-3	3-6	6-7.8	0-9	2-4	2-4	0-2	2-5	0-2	2-5	0-9
Latitude		41.6222	41.6222	41.6222	41.6223	41.6242	41.6242	41.6242	41.6242	41.6239	41.6239	41.62304
Longitude		-87.5127	-87.5127	-87.5127	-87.5127	-87.5174	-87.5174	-87.5173	-87.5173	-87.5168	-87.5168	-87.51481
Conventionals												
Acid volatile sulfides	µmol/g											
Acid volatile sulfides	mg/kg											
Ammonia-nitrogen	mg/kg	293	1130	879								
% clay sized particles	%											
% gravel sized particles	%											
% sand + gravel sized prtcls	%											
% sand sized particles	%											
% silt + clay sized particles	%											
% silt sized particles	%											
Metals												
Aluminum	mg/kg	6100	11000	14000								
Antimony	mg/kg	39	12	10								
Arsenic	mg/kg	<6.2	<11	<9.6		<25	<25	20.5	2.4	9.6	5.55	
Barium	mg/kg	180	120	110		72	87					
Beryllium	mg/kg	0.7	0.6	0.7								
Boron	mg/kg	19	21	27								
Cadmium	mg/kg	4.9	2.9	<1.2	<3	7.2	4.1	5.4	<0.5	3.2	1.5	
Calcium	mg/kg	40000	36000	26000								
Chromium	mg/kg	81	26	22	153	18	20	53.9	3.9	28.5	7.4	
Cobalt	mg/kg	5.6	11	10								
Copper	mg/kg	360	170	34	110			130	5.7	109	63.5	
Cyanide	mg/kg					3.7	2.3					
Iron	mg/kg	27000	31000	30000	21400							
Lead	mg/kg	390	180	<18	173	280	190	556	8	166	114	
Lithium	mg/kg	6.7	20	24								
Magnesium	mg/kg	13000	17000	14000	13207							
Manganese	mg/kg	890	490	420	460							
Mercury	mg/kg					2.06	<0.1	1.5	0.11	1.2	0.89	
Molybdenum	mg/kg	3.8	2.3	3								
Nickel	mg/kg	25	27	32	<26			68.9	6.5	10.5	8.15	
Potassium	mg/kg	500	1400	1800								
Selenium	mg/kg					<25	<25					
Silver	mg/kg	65	<0.8	<0.7		0.9	1.1					
Sodium	mg/kg	380	340	350								
Strontium	mg/kg	52	46	43								
Thallium	mg/kg											

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	4 SOHL2-33	4 SOHL2-35	4 SOHL2-96	4 UH9.3	5 SD-1	5 SD-1D	5 SD-98-25/0-2'	5 SD-98-25/2-5'	5 SD-98-26/0-2'	5 SD-98-26/2-5'	5 UH 9.4 all
Tin	mg/kg	31	11	<4.8								
Titanium	mg/kg	180	200	210								
Vanadium	mg/kg	18	23	25								
Zinc	mg/kg	1000	720	140	453			1320	25.9	924	339	
Volatile Organic Compounds												
1,2,4-Trichlorobenzene	µg/kg											
1,2-Dichlorobenzene	µg/kg											
1,3-Dichlorobenzene	µg/kg											
1,4-Dichlorobenzene	µg/kg											
Benzene	µg/kg					<50	<20	<50000	<620	<6200	<620	
Semi-Volatile Organic Compounds												
1,2,3,4-Tetrachlorobenzene	µg/kg											
1,2,3,5-Tetrachlorobenzene	µg/kg											
1,2-Dinitrobenzene	µg/kg											
1,2-Diphenylhydrazine	µg/kg											
1,3-Dinitrobenzene	µg/kg											
1,4-Dinitrobenzene	µg/kg											
2,2'-Oxybis(1-chloropropane)	µg/kg											
2,3,4,6-Tetrachlorophenol	µg/kg											
2,4,5-Trichlorophenol	µg/kg											
2,4,6-Trichlorophenol	µg/kg											
2,4-Dichlorophenol	µg/kg											
2,4-Dimethylphenol	µg/kg											
2,4-Dinitrophenol	µg/kg											
2,4-Dinitrotoluene	µg/kg											
2,6-Dinitrotoluene	µg/kg											
2-Chloronaphthalene	µg/kg											
2-Chlorophenol	µg/kg											
2-Methylnaphthalene	µg/kg	7500	130000	25000		<33000	<33000	79000	13000	59000	2700	
2-Methylphenol	µg/kg											
2-Nitroaniline	µg/kg											
2-Nitrophenol	µg/kg											
2-Picoline	µg/kg											
3,3'-Dichlorobenzidine	µg/kg											
3-Nitroaniline	µg/kg											
4,6-Dinitro-2-methylphenol	µg/kg											
4-Bromophenyl phenyl ether	µg/kg											
4-Chloro-3-methylphenol	µg/kg											
4-Chloroaniline	µg/kg											
4-Chlorophenyl phenyl ether	µg/kg											

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	4 SOHL2-33	4 SOHL2-35	4 SOHL2-96	4 UH9.3	5 SD-1	5 SD-1D	5 SD-98-25/0-2'	5 SD-98-25/2-5'	5 SD-98-26/0-2'	5 SD-98-26/2-5'	5 UH 9.4 all
4-Methylphenol	µg/kg											
4-Nitroaniline	µg/kg											
4-Nitrophenol	µg/kg											
Acenaphthene	µg/kg	11000	87000	16000		<33000	48000	61000	11000	37000	1500	
Acenaphthylene	µg/kg	<5800	<21000	<7000		<33000	<33000	<66000	<6600	<33000	175	
Aniline	µg/kg											
Anthracene	µg/kg	6000	32000	8200		<33000	<33000	26000	3900	22000	1300	
Benzidine	µg/kg											
Benzo(a)anthracene	µg/kg	8500	34000	5000		<33000	<33000	20000	1700	14000	1400	
Benzo(a)pyrene	µg/kg	4200	18000	2700	119000	<33000	<33000	<66000	<6600	<33000	1150	<20
Benzo(b)fluoranthene	µg/kg											
Benzo(g,h,i)perylene	µg/kg											
Benzo(k)fluoranthene	µg/kg	1700	<21000	<7000		<33000	<33000	<66000	<6600	<33000	490	
Benzoic acid	µg/kg											
Benzyl alcohol	µg/kg											
Bis(2-chloroethoxy)methane	µg/kg											
Bis(2-chloroethyl)ether	µg/kg											
Bis(2-ethylhexyl)phthalate	µg/kg											
Butylbenzylphthalate	µg/kg											
Carbazole	µg/kg											
Chrysene	µg/kg	10000	38000	4700		<33000	<33000	37000	1800	14000	1650	
Dibenz(a,h)anthracene	µg/kg	<5800	<21000	<7000				<66000	<6600	<33000	<660	
Dibenzofuran	µg/kg							<66000	<6600	2300	91	
Diethylphthalate	µg/kg											
Dimethylphthalate	µg/kg											
Di-n-butyl phthalate	µg/kg											
Di-n-octylphthalate	µg/kg											
Fluoranthene	µg/kg	14000	53000	8600	12100	<33000	<33000	30000	3600	25000	2700	
Fluorene	µg/kg	5700	37000	8100		<33000	<33000	27000	4100	18000	895	
Hexachlorobenzene	µg/kg											
Hexachlorobutadiene	µg/kg											
Hexachlorocyclopentadiene	µg/kg											
Hexachloroethane	µg/kg											
Indeno(1,2,3-c,d)pyrene	µg/kg	3400	11000	<7000				<66000	<6600	<33000	<660	
Isophorone	µg/kg											
Naphthalene	µg/kg	6100	180000	52000	150	<33000	<33000	130000	15000	50000	4000	
Nitrobenzene	µg/kg											
N-nitrosodimethylamine	µg/kg											
N-nitrosodi-N-propylamine	µg/kg											
N-nitrosodiphenylamine	µg/kg											
Pentachlorophenol	µg/kg											

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	4 SOHL2-33	4 SOHL2-35	4 SOHL2-96	4 UH9.3	5 SD-1	5 SD-1D	5 SD-98-25/0-2'	5 SD-98-25/2-5'	5 SD-98-26/0-2'	5 SD-98-26/2-5'	5 UH 9.4 all
Phenanthrene	µg/kg	22000	120000	29000	2160	66000	75000	110000	12000	68000	4350	
Phenol (µg/kg units)	µg/kg	<5800	<21000	<7000	60							
Phenol (mg/kg units)	mg/kg							<66	<6.6	<33	<0.66	
Pyrene	µg/kg	17000	70000	13000	5630	<33000	33000	59000	5400	39000	3750	
Pyridine	µg/kg											
TIC	µg/kg											
Toluene-2,4-diamine	µg/kg											
Total HMW-PAHs (13 PAHs)	µg/kg	56600	223500	37500	136730	<165000	99000	212000	19100	125000	10980	<20
Total HMW-PAHs***	µg/kg	53700	213000	34000	136730		33000	146000	12500	92000	10650	<20
Total LMW-PAHs (13 PAHs)	µg/kg	61200	596500	141800	2310	165000	205500	466000	62300	270500	14920	
Total LMW-PAHs***	µg/kg	58300	586000	138300	2310	66000	123000	433000	59000	254000	14920	
Total PAHs (13 PAHs)	µg/kg	117800	820000	179300	139040	247500	304500	678000	81400	395500	25900	<20
Total PAHs***	µg/kg	112000	799000	172300	139040	66000	156000	579000	71500	346000	25570	<20
Unknown	µg/kg											
Polychorinated Biphenyls												
Aroclor 1016	µg/kg					<1000	<4000					
Aroclor 1221	µg/kg					<1000	<4000					
Aroclor 1232	µg/kg					<1000	<4000					
Aroclor 1242	µg/kg					<1000	<4000					
Aroclor 1248	µg/kg				9210	<1000	<4000					
Aroclor 1254	µg/kg					<1000	<4000					
Aroclor 1260	µg/kg					<1000	<4000					
Total PCBs	µg/kg				9210	<7000	<28000					420
Total PCBs**	µg/kg											
Pesticides												
Aldrin	µg/kg											
Chlordane	µg/kg				4210							<0.4
Chlordane - alpha	µg/kg											
Chlordane - gamma	µg/kg											
Chlordane - reported*	µg/kg											
Dieldrin	µg/kg				5070							<0.4
Dieldrin only (not Aldrin)	µg/kg											
Endosulfan sulfate	µg/kg											
Endosulfan-alpha	µg/kg											
Endosulfan-beta	µg/kg											
Endrin	µg/kg											
Endrin ketone	µg/kg											
Heptachlor	µg/kg				930							<0.4
Heptachlor + Hept. epox.**	µg/kg											
Heptachlor epoxide	µg/kg											
Hexachlorocyclohexane**	µg/kg											

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	4 SOHL2-33	4 SOHL2-35	4 SOHL2-96	4 UH9.3	5 SD-1	5 SD-1D	5 SD-98-25/0-2'	5 SD-98-25/2-5'	5 SD-98-26/0-2'	5 SD-98-26/2-5'	5 UH 9.4 all
Hexachlorocyclohexane-α	µg/kg											
Hexachlorocyclohexane-β	µg/kg											
Hexachlorocyclohexane-δ	µg/kg											
Lindane	µg/kg				3220							<0.4
Methoxychlor	µg/kg											
o,p'-DDD	µg/kg											
o,p'-DDE	µg/kg											
o,p'-DDT	µg/kg											
p,p'-DDD	µg/kg											
p,p'-DDE	µg/kg											
p,p'-DDT	µg/kg											
Sum DDD	µg/kg											
Sum DDD**	µg/kg											
Sum DDE	µg/kg											
Sum DDE**	µg/kg											
Sum DDT	µg/kg											
Sum DDT**	µg/kg											
Total DDT	µg/kg				13960							1.3
Total DDT**	µg/kg											
Total DDT***	µg/kg				13960							1.3
Toxaphene	µg/kg				4660							<0.4
Dioxins												
2,3,7,8-Dibenzo-p-dioxin	µg/kg				<0.002							

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	5 UH9.4	5 UH9.4/0.9	5 UH9.4/11.2	5 UH9.4/5.9	6 050-88	6 SD-10	6 SD-11	6 SD-15	6 SD-15d	6 SD-15d2	6 SD-15d3	6 SD-2	6 SD-3
Location														
Depth	feet	0-9	0.8-1	11.1-11.2	5.7-6	Surface	0-2	2-4	0-2	2-3	3-4	4-5	2-4	2-4
Latitude		41.6228	41.62304	41.62304	41.62304	41.6243	41.6255	41.6257	41.6252	41.6252	41.6252	41.6252	41.6245	41.6246
Longitude		-87.5143	-87.51481	-87.51481	-87.51481	-87.5176	-87.5201	-87.5207	-87.5193	-87.5193	-87.5193	-87.5193	-87.5178	-87.5181
Conventionals														
Acid volatile sulfides	µmol/g													
Acid volatile sulfides	mg/kg													
Ammonia-nitrogen	mg/kg													
% clay sized particles	%													
% gravel sized particles	%													
% sand + gravel sized prtcls	%													
% sand sized particles	%													
% silt + clay sized particles	%													
% silt sized particles	%													
Metals														
Aluminum	mg/kg					9900								
Antimony	mg/kg					212								
Arsenic	mg/kg					6	<25	<25	31	<25	<25	<25	<25	<25
Barium	mg/kg					500	52	17	150	150	150	41	81	50
Beryllium	mg/kg					<1.6								
Boron	mg/kg													
Cadmium	mg/kg	5	10.4	<1.5	<1.5	10.3	0.89	1	11	2.1	3	0.86	1.2	0.63
Calcium	mg/kg					51900								
Chromium	mg/kg	191				207	14	10	90	42	82	5.8	29	14
Cobalt	mg/kg					<16								
Copper	mg/kg	180	838	<4	49	490								
Cyanide	mg/kg					<0.1	2	12	2.8	4.8	3.5	2.4	1.5	3.1
Iron	mg/kg	14600				33000								
Lead	mg/kg	493	1885	<30	70	426	200	100	310	160	200	70	160	76
Lithium	mg/kg													
Magnesium	mg/kg	11600				12700								
Manganese	mg/kg	372				2860								
Mercury	mg/kg					3.67	0.59	0	0.9	0.5	1.67	0.43	2.53	1.36
Molybdenum	mg/kg													
Nickel	mg/kg	63	160	<20	<20	34								
Potassium	mg/kg					<1600								
Selenium	mg/kg					<8.1	<25	<25	<25	<25	<25	<25	<25	<25
Silver	mg/kg					7.7	<0.5	<1	2	<0.5	1.5	<0.5	1.4	<0.5
Sodium	mg/kg					<1600								
Strontium	mg/kg													
Thallium	mg/kg					<6.5								

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	5 UH9.4	5 UH9.4/0.9	5 UH9.4/11.2	5 UH9.4/5.9	6 050-88	6 SD-10	6 SD-11	6 SD-15	6 SD-15d	6 SD-15d2	6 SD-15d3	6 SD-2	6 SD-3
Tin	mg/kg													
Titanium	mg/kg													
Vanadium	mg/kg					29.5								
Zinc	mg/kg	1180	3140	26	180	705								
Volatile Organic Compounds														
1,2,4-Trichlorobenzene	µg/kg													
1,2-Dichlorobenzene	µg/kg													
1,3-Dichlorobenzene	µg/kg													
1,4-Dichlorobenzene	µg/kg													
Benzene	µg/kg					<80	<500	10000	<80	380	770	1200	<20	30
Semi-Volatile Organic Compounds														
1,2,3,4-Tetrachlorobenzene	µg/kg													
1,2,3,5-Tetrachlorobenzene	µg/kg													
1,2-Dinitrobenzene	µg/kg													
1,2-Diphenylhydrazine	µg/kg													
1,3-Dinitrobenzene	µg/kg													
1,4-Dinitrobenzene	µg/kg													
2,2'-Oxybis(1-chloropropane)	µg/kg													
2,3,4,6-Tetrachlorophenol	µg/kg													
2,4,5-Trichlorophenol	µg/kg													
2,4,6-Trichlorophenol	µg/kg													
2,4-Dichlorophenol	µg/kg													
2,4-Dimethylphenol	µg/kg													
2,4-Dinitrophenol	µg/kg													
2,4-Dinitrotoluene	µg/kg													
2,6-Dinitrotoluene	µg/kg													
2-Chloronaphthalene	µg/kg													
2-Chlorophenol	µg/kg													
2-Methylnaphthalene	µg/kg					2000	<33000	320000	<33000	1600000	630000	110000	57000	<33000
2-Methylphenol	µg/kg													
2-Nitroaniline	µg/kg													
2-Nitrophenol	µg/kg													
2-Picoline	µg/kg													
3,3'-Dichlorobenzidine	µg/kg													
3-Nitroaniline	µg/kg													
4,6-Dinitro-2-methylphenol	µg/kg													
4-Bromophenyl phenyl ether	µg/kg													
4-Chloro-3-methylphenol	µg/kg													
4-Chloroaniline	µg/kg													
4-Chlorophenyl phenyl ether	µg/kg													

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	5 UH9.4	5 UH9.4/0.9	5 UH9.4/11.2	5 UH9.4/5.9	6 050-88	6 SD-10	6 SD-11	6 SD-15	6 SD-15d	6 SD-15d2	6 SD-15d3	6 SD-2	6 SD-3
4-Methylphenol	µg/kg													
4-Nitroaniline	µg/kg													
4-Nitrophenol	µg/kg													
Acenaphthene	µg/kg					<11000	160000	230000	<33000	1400000	390000	86000	40000	<33000
Acenaphthylene	µg/kg					610	<33000	<33000	<33000	<165000	<66000	<33000	<33000	<33000
Aniline	µg/kg													
Anthracene	µg/kg					1900	65000	81000	<33000	520000	150000	<33000	<33000	<33000
Benzidine	µg/kg													
Benzo(a)anthracene	µg/kg					3000	52000	38000	<33000	210000	<66000	<33000	<33000	<33000
Benzo(a)pyrene	µg/kg	45600				3500	43000	<33000	<33000	<165000	<66000	<33000	<33000	<33000
Benzo(b)fluoranthene	µg/kg													
Benzo(g,h,i)perylene	µg/kg													
Benzo(k)fluoranthene	µg/kg					3900	<33000	<33000	<33000	<165000	<66000	<33000	<33000	<33000
Benzoic acid	µg/kg													
Benzyl alcohol	µg/kg													
Bis(2-chloroethoxy)methane	µg/kg													
Bis(2-chloroethyl)ether	µg/kg													
Bis(2-ethylhexyl)phthalate	µg/kg													
Butylbenzylphthalate	µg/kg													
Carbazole	µg/kg													
Chrysene	µg/kg					4800	51000	38000	<33000	210000	70000	<33000	<33000	<33000
Dibenz(a,h)anthracene	µg/kg					<11000								
Dibenzofuran	µg/kg													
Diethylphthalate	µg/kg													
Dimethylphthalate	µg/kg													
Di-n-butyl phthalate	µg/kg													
Di-n-octylphthalate	µg/kg													
Fluoranthene	µg/kg	1620				8900	100000	77000	<33000	400000	120000	42000	<33000	<33000
Fluorene	µg/kg					<11000	77000	100000	<33000	530000	180000	<33000	<33000	<33000
Hexachlorobenzene	µg/kg													
Hexachlorobutadiene	µg/kg													
Hexachlorocyclopentadiene	µg/kg													
Hexachloroethane	µg/kg													
Indeno(1,2,3-c,d)pyrene	µg/kg					<11000								
Isophorone	µg/kg													
Naphthalene	µg/kg	8230				<11000	50000	380000	<33000	1700000	660000	180000	33000	<33000
Nitrobenzene	µg/kg													
N-nitrosodimethylamine	µg/kg													
N-nitrosodi-N-propylamine	µg/kg													
N-nitrosodiphenylamine	µg/kg													
Pentachlorophenol	µg/kg													

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

		5	5	5	5	6	6	6	6	6	6	6	6	6
Substance	**Units**	**UH9.4**	**UH9.4/0.9**	**UH9.4/11.2**	**UH9.4/5.9**	**050-88**	**SD-10**	**SD-11**	**SD-15**	**SD-15d**	**SD-15d2**	**SD-15d3**	**SD-2**	**SD-3**
Phenanthrene	µg/kg	1580				7200	220000	230000	<33000	1500000	450000	96000	71000	<33000
Phenol (µg/kg units)	µg/kg	<10												
Phenol (mg/kg units)	mg/kg					<11								
Pyrene	µg/kg	4810				9900	150000	110000	<33000	720000	210000	<33000	43000	<33000
Pyridine	µg/kg													
TIC	µg/kg													
Toluene-2,4-diamine	µg/kg													
Total HMW-PAHs (13 PAHs)	µg/kg	52030				35600	396000	279500	<165000	1622500	466000	108000	109000	<165000
Total HMW-PAHs***	µg/kg	52030				30100	396000	263000		1540000	400000	42000	43000	
Total LMW-PAHs (13 PAHs)	µg/kg	9810				28210	605000	17841	<231000	89750	35460	49972	250500	<231000
Total LMW-PAHs***	µg/kg	9810				11710	572000	1341000		7250000	2460000	472000	201000	
Total PAHs (13 PAHs)	µg/kg	61840				63810	1001000	297341	<396000	1712250	501460	157972	359500	<396000
Total PAHs***	µg/kg	61840				41810	968000	1604000		8790000	2860000	514000	244000	
Unknown	µg/kg													
Polychorinated Biphenyls														
Aroclor 1016	µg/kg					<641	<4000	<4000	<1000	<4000	<1000	<1000	<4000	<4000
Aroclor 1221	µg/kg					<641	<4000	<4000	<1000	<4000	<1000	<1000	<4000	<4000
Aroclor 1232	µg/kg					<641	<4000	<4000	<1000	<4000	<1000	<1000	<4000	<4000
Aroclor 1242	µg/kg					<641	<4000	<4000	<1000	<4000	<1000	<1000	<4000	<4000
Aroclor 1248	µg/kg	4280				676.3	<4000	<4000	<1000	<4000	<1000	<1000	<4000	<4000
Aroclor 1254	µg/kg					<641	<4000	<4000	<1000	<4000	<1000	<1000	<4000	<4000
Aroclor 1260	µg/kg					<641	<4000	<4000	<1000	<4000	<1000	<1000	<4000	<4000
Total PCBs	µg/kg	4280				2599.3	<28000	<28000	<7000	<28000	<7000	<7000	<28000	<28000
Total PCBs**	µg/kg													
Pesticides														
Aldrin	µg/kg													
Chlordane	µg/kg	4660				<64.2								
Chlordane - alpha	µg/kg					<32.1								
Chlordane - gamma	µg/kg					<32.1								
Chlordane - reported*	µg/kg													
Dieldrin	µg/kg	2880				<32.1								
Dieldrin only (not Aldrin)	µg/kg													
Endosulfan sulfate	µg/kg													
Endosulfan-alpha	µg/kg													
Endosulfan-beta	µg/kg													
Endrin	µg/kg					<320.5								
Endrin ketone	µg/kg													
Heptachlor	µg/kg	40				<240.4								
Heptachlor + Hept. epox.**	µg/kg													
Heptachlor epoxide	µg/kg					<160.3								
Hexachlorocyclohexane**	µg/kg													

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	5 UH9.4	5 UH9.4/0.9	5 UH9.4/11.2	5 UH9.4/5.9	6 050-88	6 SD-10	6 SD-11	6 SD-15	6 SD-15d	6 SD-15d2	6 SD-15d3	6 SD-2	6 SD-3
Hexachlorocyclohexane-α	µg/kg													
Hexachlorocyclohexane-β	µg/kg													
Hexachlorocyclohexane-δ	µg/kg													
Lindane	µg/kg	2430				240.4								
Methoxychlor	µg/kg													
o,p'-DDD	µg/kg					<64.1								
o,p'-DDE	µg/kg					<64.1								
o,p'-DDT	µg/kg					<64.1								
p,p'-DDD	µg/kg					198.7								
p,p'-DDE	µg/kg					<64.1								
p,p'-DDT	µg/kg					<64.1								
Sum DDD	µg/kg													
Sum DDD**	µg/kg													
Sum DDE	µg/kg													
Sum DDE**	µg/kg													
Sum DDT	µg/kg													
Sum DDT**	µg/kg													
Total DDT	µg/kg	17010				358.95								
Total DDT**	µg/kg													
Total DDT***	µg/kg	17010				230.75								
Toxaphene	µg/kg	6490												
Dioxins														
2,3,7,8-Dibenzo-p-dioxin	µg/kg	<0.004												

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	6 SD-4	6 SD-5	6 SD-6	6 SD-7	6 SD-9	6 SD-98-17/2-5'	6 SD-98-17S/0-2'	6 SD-98-18/0-2'	6 SD-98-18/2-4'	6 SD-98-19/0-2'
Location											
Depth	feet	2-4	2-4	2-4	2-4	2-4	2-5	0-2	0-2	2-4	0-2
Latitude		41.6248	41.625	41.6252	41.6253	41.6254	41.6257	41.6257	41.6255	41.6255	41.6254
Longitude		-87.5184	-87.5187	-87.5191	-87.5195	-87.5198	-87.5208	-87.5208	-87.5199	-87.5199	-87.5199
Conventionals											
Acid volatile sulfides	µmol/g										
Acid volatile sulfides	mg/kg										
Ammonia-nitrogen	mg/kg										
% clay sized particles	%										
% gravel sized particles	%						0	0			
% sand + gravel sized prtcls	%										
% sand sized particles	%						36.1	49.1			
% silt + clay sized particles	%						63.9	50.9			
% silt sized particles	%										
Metals											
Aluminum	mg/kg										
Antimony	mg/kg										
Arsenic	mg/kg	<25	<25	<25	<25	<25	3.7	5.2	7.2	2.7	6.5
Barium	mg/kg	120	32	87	41	27					
Beryllium	mg/kg										
Boron	mg/kg										
Cadmium	mg/kg	3.3	0.49	1	0.34	0.84	0.34	1.5	1.8	<0.5	1.1
Calcium	mg/kg										
Chromium	mg/kg	48	7.9	22	11	4.9	5.9	5.4	13.8	4.75	17
Cobalt	mg/kg										
Copper	mg/kg						19.8	37	81.6	10.3	87.7
Cyanide	mg/kg	4.5	0.54	2.6	3.4	2					<0.5
Iron	mg/kg										
Lead	mg/kg	210	42	180	48	37	31.7	184	154	9.05	119
Lithium	mg/kg										
Magnesium	mg/kg										
Manganese	mg/kg										
Mercury	mg/kg	1.25	0.17	1.48	<0.1	0.76	0.74	0.55	2	0.0305	3.6
Molybdenum	mg/kg										
Nickel	mg/kg						6.3	3.5	7.8	7.45	8.7
Potassium	mg/kg										
Selenium	mg/kg	<25	<25	<25	<25	<25					
Silver	mg/kg	1.6	<0.5	1.4	<0.5	<0.5					
Sodium	mg/kg										
Strontium	mg/kg										
Thallium	mg/kg										

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	6 SD-4	6 SD-5	6 SD-6	6 SD-7	6 SD-9	6 SD-98-17/2-5'	6 SD-98-17S/0-2'	6 SD-98-18/0-2'	6 SD-98-18/2-4'	6 SD-98-19/0-2'
Tin	mg/kg										
Titanium	mg/kg										
Vanadium	mg/kg										
Zinc	mg/kg						132	383	518	40.95	419
Volatile Organic Compounds											
1,2,4-Trichlorobenzene	µg/kg										
1,2-Dichlorobenzene	µg/kg										
1,3-Dichlorobenzene	µg/kg										
1,4-Dichlorobenzene	µg/kg										
Benzene	µg/kg	2900	10000	23000	21000	12000	9100	25000	570	6650	26000
Semi-Volatile Organic Compounds											
1,2,3,4-Tetrachlorobenzene	µg/kg										
1,2,3,5-Tetrachlorobenzene	µg/kg										
1,2-Dinitrobenzene	µg/kg										
1,2-Diphenylhydrazine	µg/kg										
1,3-Dinitrobenzene	µg/kg										
1,4-Dinitrobenzene	µg/kg										
2,2'-Oxybis(1-chloropropane)	µg/kg										
2,3,4,6-Tetrachlorophenol	µg/kg										
2,4,5-Trichlorophenol	µg/kg										
2,4,6-Trichlorophenol	µg/kg										
2,4-Dichlorophenol	µg/kg										
2,4-Dimethylphenol	µg/kg										
2,4-Dinitrophenol	µg/kg										
2,4-Dinitrotoluene	µg/kg										
2,6-Dinitrotoluene	µg/kg										
2-Chloronaphthalene	µg/kg										
2-Chlorophenol	µg/kg										
2-Methylnaphthalene	µg/kg	370000	440000	1400000	640000	900000	150000	630000	2800	72000	610000
2-Methylphenol	µg/kg										
2-Nitroaniline	µg/kg										
2-Nitrophenol	µg/kg										
2-Picoline	µg/kg										
3,3'-Dichlorobenzidine	µg/kg										
3-Nitroaniline	µg/kg										
4,6-Dinitro-2-methylphenol	µg/kg										
4-Bromophenyl phenyl ether	µg/kg										
4-Chloro-3-methylphenol	µg/kg										
4-Chloroaniline	µg/kg										
4-Chlorophenyl phenyl ether	µg/kg										

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	6 SD-4	6 SD-5	6 SD-6	6 SD-7	6 SD-9	6 SD-98-17/2-5'	6 SD-98-17S/0-2'	6 SD-98-18/0-2'	6 SD-98-18/2-4'	6 SD-98-19/0-2'
4-Methylphenol	µg/kg										
4-Nitroaniline	µg/kg										
4-Nitrophenol	µg/kg										
Acenaphthene	µg/kg	340000	360000	920000	650000	890000	97000	340000	31000	67000	500000
Acenaphthylene	µg/kg	<33000	<33000	50000	<66000	<33000	<33000	33000	1100	8850	25000
Aniline	µg/kg										
Anthracene	µg/kg	120000	133000	220000	220000	210000	34000	130000	16000	23500	160000
Benzidine	µg/kg										
Benzo(a)anthracene	µg/kg	47000	53000	120000	140000	170000	15000	66000	9700	14100	96000
Benzo(a)pyrene	µg/kg	<33000	<33000	60000	100000	120000	<33000	52000	6200	11100	74000
Benzo(b)fluoranthene	µg/kg										
Benzo(g,h,i)perylene	µg/kg										
Benzo(k)fluoranthene	µg/kg	<33000	<33000	<33000	<66000	33000	<33000	14000	1900	9050	22000
Benzoic acid	µg/kg										
Benzyl alcohol	µg/kg										
Bis(2-chloroethoxy)methane	µg/kg										
Bis(2-chloroethyl)ether	µg/kg										
Bis(2-ethylhexyl)phthalate	µg/kg										
Butylbenzylphthalate	µg/kg										
Carbazole	µg/kg										
Chrysene	µg/kg	40000	55000	140000	120000	130000	14000	68000	11000	13350	88000
Dibenz(a,h)anthracene	µg/kg						<33000	<66000	<3300	<33000	<66000
Dibenzofuran	µg/kg						5100	22000	1800	3100	24000
Diethylphthalate	µg/kg										
Dimethylphthalate	µg/kg										
Di-n-butyl phthalate	µg/kg										
Di-n-octylphthalate	µg/kg										
Fluoranthene	µg/kg	100000	110000	190000	310000	300000	31000	120000	14000	34000	220000
Fluorene	µg/kg	140000	170000	270000	300000	280000	40000	160000	14000	31000	220000
Hexachlorobenzene	µg/kg										
Hexachlorobutadiene	µg/kg										
Hexachlorocyclopentadiene	µg/kg										
Hexachloroethane	µg/kg										
Indeno(1,2,3-c,d)pyrene	µg/kg						<33000	<66000	<3300	<33000	<66000
Isophorone	µg/kg										
Naphthalene	µg/kg	580000	530000	1500000	980000	1400000	220000	820000	8300	131000	1000000
Nitrobenzene	µg/kg										
N-nitrosodimethylamine	µg/kg										
N-nitrosodi-N-propylamine	µg/kg										
N-nitrosodiphenylamine	µg/kg										
Pentachlorophenol	µg/kg										

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	6 SD-4	6 SD-5	6 SD-6	6 SD-7	6 SD-9	6 SD-98-17/2-5'	6 SD-98-17S/0-2'	6 SD-98-18/0-2'	6 SD-98-18/2-4'	6 SD-98-19/0-2'
Phenanthrene	µg/kg	350000	330000	820000	670000	930000	110000	440000	49000	100000	650000
Phenol (µg/kg units)	µg/kg										
Phenol (mg/kg units)	mg/kg						<33	<66	<3.3	<33	<66
Pyrene	µg/kg	210000	170000	300000	430000	530000	47000	190000	20000	49000	300000
Pyridine	µg/kg										
TIC	µg/kg										
Toluene-2,4-diamine	µg/kg										
Total HMW-PAHs (13 PAHs)	µg/kg	413500	404500	810000	1100000	1250000	140000	529000	62550	138050	811000
Total HMW-PAHs***	µg/kg	397000	388000	810000	1100000	1250000	107000	496000	60900	121550	778000
Total LMW-PAHs (13 PAHs)	µg/kg	1916500	1979500	5180000	3493000	4626500	667500	2553000	122200	433350	3165000
Total LMW-PAHs***	µg/kg	1900000	1963000	5180000	3460000	4610000	651000	2553000	122200	433350	3165000
Total PAHs (13 PAHs)	µg/kg	2330000	2384000	5990000	4593000	5876500	807500	3082000	184750	571400	3976000
Total PAHs***	µg/kg	2297000	2351000	5990000	4560000	5860000	758000	3049000	183100	554900	3943000
Unknown	µg/kg										
Polychorinated Biphenyls											
Aroclor 1016	µg/kg	<4000	<4000	<4000	<4000	<4000					
Aroclor 1221	µg/kg	<4000	<4000	<4000	<4000	<4000					
Aroclor 1232	µg/kg	<4000	<4000	<4000	<4000	<4000					
Aroclor 1242	µg/kg	<4000	<4000	<4000	<4000	<4000					
Aroclor 1248	µg/kg	<4000	<4000	<4000	<4000	<4000					
Aroclor 1254	µg/kg	<4000	<4000	<4000	<4000	<4000					
Aroclor 1260	µg/kg	<4000	<4000	<4000	<4000	<4000					
Total PCBs	µg/kg	<28000	<28000	<28000	<28000	<28000					
Total PCBs**	µg/kg										
Pesticides											
Aldrin	µg/kg										
Chlordane	µg/kg										
Chlordane - alpha	µg/kg										
Chlordane - gamma	µg/kg										
Chlordane - reported*	µg/kg										
Dieldrin	µg/kg										
Dieldrin only (not Aldrin)	µg/kg										
Endosulfan sulfate	µg/kg										
Endosulfan-alpha	µg/kg										
Endosulfan-beta	µg/kg										
Endrin	µg/kg										
Endrin ketone	µg/kg										
Heptachlor	µg/kg										
Heptachlor + Hept. epox.**	µg/kg										
Heptachlor epoxide	µg/kg										
Hexachlorocyclohexane**	µg/kg										

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	6 SD-4	6 SD-5	6 SD-6	6 SD-7	6 SD-9	6 SD-98-17/2-5'	6 SD-98-17S/0-2'	6 SD-98-18/0-2'	6 SD-98-18/2-4'	6 SD-98-19/0-2'
Hexachlorocyclohexane-α	µg/kg										
Hexachlorocyclohexane-β	µg/kg										
Hexachlorocyclohexane-δ	µg/kg										
Lindane	µg/kg										
Methoxychlor	µg/kg										
o,p'-DDD	µg/kg										
o,p'-DDE	µg/kg										
o,p'-DDT	µg/kg										
p,p'-DDD	µg/kg										
p,p'-DDE	µg/kg										
p,p'-DDT	µg/kg										
Sum DDD	µg/kg										
Sum DDD**	µg/kg										
Sum DDE	µg/kg										
Sum DDE**	µg/kg										
Sum DDT	µg/kg										
Sum DDT**	µg/kg										
Total DDT	µg/kg										
Total DDT**	µg/kg										
Total DDT***	µg/kg										
Toxaphene	µg/kg										
Dioxins											
2,3,7,8-Dibenzo-p-dioxin	µg/kg										

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	6 SD-98-19/2-5'	6 SD-98-20/0-2'	6 SD-98-20/2-4'	6 SD-98-20S/0-0.83	6 SD-98-21/0-2'	6 SD-98-21/2-4'	6 SD-98-22/0-2'	6 SD-98-22/2-4'	6 SD-98-23/0-2'
Location										
Depth	feet	2-5	0-2	2-4	0-0.83	0-2	2-4	0-2	2-4	0-2
Latitude		41.6254	41.6253	41.6253	41.6253	41.6252	41.6252	41.6249	41.6249	41.6249
Longitude		-87.5199	-87.5193	-87.5193	-87.5193	-87.5193	-87.5193	-87.5186	-87.5186	-87.5187
Conventionals										
Acid volatile sulfides	µmol/g									
Acid volatile sulfides	mg/kg									
Ammonia-nitrogen	mg/kg									
% clay sized particles	%									
% gravel sized particles	%		0	0						
% sand + gravel sized prtcls	%									
% sand sized particles	%		38.9	54.3						
% silt + clay sized particles	%		61.1	45.7						
% silt sized particles	%									
Metals										
Aluminum	mg/kg									
Antimony	mg/kg									
Arsenic	mg/kg	3.8	9.4	4.2	26.5	6.6	2.2	14.3	5	7.8
Barium	mg/kg									
Beryllium	mg/kg									
Boron	mg/kg									
Cadmium	mg/kg	<0.5	1.6	0.41	24.4	1.7	<0.5	5.8	0.47	3.3
Calcium	mg/kg									
Chromium	mg/kg	4.5	18	5.4	86.3	22.6	4.7	63	5.9	61.5
Cobalt	mg/kg									
Copper	mg/kg	24.6	91.4	26.4	174	87.4	8.7	156	40.1	169
Cyanide	mg/kg	<0.5	<0.5	<0.5	<0.5					1.8
Iron	mg/kg									
Lead	mg/kg	37.6	185	43.8	305	141	8.2	287	73	233
Lithium	mg/kg									
Magnesium	mg/kg									
Manganese	mg/kg									
Mercury	mg/kg	0.29	3.1	0.39	1.4	4.4	<0.1	1.3	0.65	2.8
Molybdenum	mg/kg									
Nickel	mg/kg	6.4	19.8	7.1	30.6	8.8	7.5	26.5	7.1	15.6
Potassium	mg/kg									
Selenium	mg/kg									
Silver	mg/kg									
Sodium	mg/kg									
Strontium	mg/kg									
Thallium	mg/kg									

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	6 SD-98-19/2-5'	6 SD-98-20/0-2'	6 SD-98-20/2-4'	6 SD-98-20S/0-0.83	6 SD-98-21/0-2'	6 SD-98-21/2-4'	6 SD-98-22/0-2'	6 SD-98-22/2-4'	6 SD-98-23/0-2'
Tin	mg/kg									
Titanium	mg/kg									
Vanadium	mg/kg									
Zinc	mg/kg	169	603	157	1780	461	35.4	997	231	675
Volatile Organic Compounds										
1,2,4-Trichlorobenzene	µg/kg									
1,2-Dichlorobenzene	µg/kg									
1,3-Dichlorobenzene	µg/kg									
1,4-Dichlorobenzene	µg/kg									
Benzene	µg/kg	17000	44000	<50000	14000	42000	18000	8200	26000	15000
Semi-Volatile Organic Compounds										
1,2,3,4-Tetrachlorobenzene	µg/kg									
1,2,3,5-Tetrachlorobenzene	µg/kg									
1,2-Dinitrobenzene	µg/kg									
1,2-Diphenylhydrazine	µg/kg									
1,3-Dinitrobenzene	µg/kg									
1,4-Dinitrobenzene	µg/kg									
2,2'-Oxybis(1-chloropropane)	µg/kg									
2,3,4,6-Tetrachlorophenol	µg/kg									
2,4,5-Trichlorophenol	µg/kg									
2,4,6-Trichlorophenol	µg/kg									
2,4-Dichlorophenol	µg/kg									
2,4-Dimethylphenol	µg/kg									
2,4-Dinitrophenol	µg/kg									
2,4-Dinitrotoluene	µg/kg									
2,6-Dinitrotoluene	µg/kg									
2-Chloronaphthalene	µg/kg									
2-Chlorophenol	µg/kg									
2-Methylnaphthalene	µg/kg	440000	900000	720000	65000	290000	210000	41000	250000	660000
2-Methylphenol	µg/kg									
2-Nitroaniline	µg/kg									
2-Nitrophenol	µg/kg									
2-Picoline	µg/kg									
3,3'-Dichlorobenzidine	µg/kg									
3-Nitroaniline	µg/kg									
4,6-Dinitro-2-methylphenol	µg/kg									
4-Bromophenyl phenyl ether	µg/kg									
4-Chloro-3-methylphenol	µg/kg									
4-Chloroaniline	µg/kg									
4-Chlorophenyl phenyl ether	µg/kg									

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	6 SD-98-19/2-5'	6 SD-98-20/0-2'	6 SD-98-20/2-4'	6 SD-98-20S/0-0.83	6 SD-98-21/0-2'	6 SD-98-21/2-4'	6 SD-98-22/0-2'	6 SD-98-22/2-4'	6 SD-98-23/0-2'
4-Methylphenol	µg/kg									
4-Nitroaniline	µg/kg									
4-Nitrophenol	µg/kg									
Acenaphthene	µg/kg	350000	510000	590000	84000	200000	180000	44000	270000	530000
Acenaphthylene	µg/kg	17000	20000	<330000	<26000	<66000	<66000	<33000	7600	12000
Aniline	µg/kg									
Anthracene	µg/kg	120000	160000	220000	21000	64000	64000	19000	170000	340000
Benzidine	µg/kg									
Benzo(a)anthracene	µg/kg	74000	66000	120000	12000	27000	34000	18000	47000	75000
Benzo(a)pyrene	µg/kg	58000	<130000	<330000	9200	<66000	26000	15000	41000	61000
Benzo(b)fluoranthene	µg/kg									
Benzo(g,h,i)perylene	µg/kg									
Benzo(k)fluoranthene	µg/kg	18000	<130000	<330000	<26000	<66000	<66000	<33000	12000	16000
Benzoic acid	µg/kg									
Benzyl alcohol	µg/kg									
Bis(2-chloroethoxy)methane	µg/kg									
Bis(2-chloroethyl)ether	µg/kg									
Bis(2-ethylhexyl)phthalate	µg/kg									
Butylbenzylphthalate	µg/kg									
Carbazole	µg/kg									
Chrysene	µg/kg	65000	66000	100000	25000	28000	32000	31000	52000	71000
Dibenz(a,h)anthracene	µg/kg	<66000	<130000	<330000	<26000	<66000	<66000	<33000	<66000	<66000
Dibenzofuran	µg/kg	17000	29000	<330000	5200	9600	<66000	3000	13000	25000
Diethylphthalate	µg/kg									
Dimethylphthalate	µg/kg									
Di-n-butyl phthalate	µg/kg									
Di-n-octylphthalate	µg/kg									
Fluoranthene	µg/kg	170000	130000	270000	21000	60000	78000	31000	140000	190000
Fluorene	µg/kg	160000	190000	260000	30000	81000	77000	21000	120000	210000
Hexachlorobenzene	µg/kg									
Hexachlorobutadiene	µg/kg									
Hexachlorocyclopentadiene	µg/kg									
Hexachloroethane	µg/kg									
Indeno(1,2,3-c,d)pyrene	µg/kg	<66000	<130000	<330000	<26000	<66000	<66000	<33000	<66000	<66000
Isophorone	µg/kg									
Naphthalene	µg/kg	780000	1400000	1600000	220000	480000	480000	47000	680000	1300000
Nitrobenzene	µg/kg									
N-nitrosodimethylamine	µg/kg									
N-nitrosodi-N-propylamine	µg/kg									
N-nitrosodiphenylamine	µg/kg									
Pentachlorophenol	µg/kg									

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	6 SD-98-19/2-5'	6 SD-98-20/0-2'	6 SD-98-20/2-4'	6 SD-98-20S/0-0.83	6 SD-98-21/0-2'	6 SD-98-21/2-4'	6 SD-98-22/0-2'	6 SD-98-22/2-4'	6 SD-98-23/0-2'
Phenanthrene	µg/kg	470000	530000	800000	78000	210000	230000	89000	370000	590000
Phenol (µg/kg units)	µg/kg									
Phenol (mg/kg units)	mg/kg	<66	<130	<330	<26	<66	<66	<33	<66	<66
Pyrene	µg/kg	240000	210000	380000	40000	85000	110000	55000	190000	270000
Pyridine	µg/kg									
TIC	µg/kg									
Toluene-2,4-diamine	µg/kg									
Total HMW-PAHs (13 PAHs)	µg/kg	640000	602000	1200000	120200	266000	313000	166500	503000	700000
Total HMW-PAHs***	µg/kg	607000	472000	870000	107200	200000	280000	150000	470000	667000
Total LMW-PAHs (13 PAHs)	µg/kg	2337000	3710000	4355000	511000	1358000	1274000	277500	1867600	3642000
Total LMW-PAHs***	µg/kg	2337000	3710000	4190000	498000	1325000	1241000	261000	1867600	3642000
Total PAHs (13 PAHs)	µg/kg	2977000	4312000	5555000	631200	1624000	1587000	444000	2370600	4342000
Total PAHs***	µg/kg	2944000	4182000	5060000	605200	1525000	1521000	411000	2337600	4309000
Unknown	µg/kg									
Polychorinated Biphenyls										
Aroclor 1016	µg/kg									
Aroclor 1221	µg/kg									
Aroclor 1232	µg/kg									
Aroclor 1242	µg/kg									
Aroclor 1248	µg/kg									
Aroclor 1254	µg/kg									
Aroclor 1260	µg/kg									
Total PCBs	µg/kg									
Total PCBs**	µg/kg									
Pesticides										
Aldrin	µg/kg									
Chlordane	µg/kg									
Chlordane - alpha	µg/kg									
Chlordane - gamma	µg/kg									
Chlordane - reported*	µg/kg									
Dieldrin	µg/kg									
Dieldrin only (not Aldrin)	µg/kg									
Endosulfan sulfate	µg/kg									
Endosulfan-alpha	µg/kg									
Endosulfan-beta	µg/kg									
Endrin	µg/kg									
Endrin ketone	µg/kg									
Heptachlor	µg/kg									
Heptachlor + Hept. epox.**	µg/kg									
Heptachlor epoxide	µg/kg									
Hexachlorocyclohexane**	µg/kg									

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	6 SD-98-19/2-5'	6 SD-98-20/0-2'	6 SD-98-20/2-4'	6 SD-98-20S/0-0.83	6 SD-98-21/0-2'	6 SD-98-21/2-4'	6 SD-98-22/0-2'	6 SD-98-22/2-4'	6 SD-98-23/0-2'
Hexachlorocyclohexane-α	µg/kg									
Hexachlorocyclohexane-β	µg/kg									
Hexachlorocyclohexane-δ	µg/kg									
Lindane	µg/kg									
Methoxychlor	µg/kg									
o,p'-DDD	µg/kg									
o,p'-DDE	µg/kg									
o,p'-DDT	µg/kg									
p,p'-DDD	µg/kg									
p,p'-DDE	µg/kg									
p,p'-DDT	µg/kg									
Sum DDD	µg/kg									
Sum DDD**	µg/kg									
Sum DDE	µg/kg									
Sum DDE**	µg/kg									
Sum DDT	µg/kg									
Sum DDT**	µg/kg									
Total DDT	µg/kg									
Total DDT**	µg/kg									
Total DDT***	µg/kg									
Toxaphene	µg/kg									
Dioxins										
2,3,7,8-Dibenzo-p-dioxin	µg/kg									

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	6 SD-98-23/2-4.5'	6 SD-98-24/0-2'	6 SD-98-24/2-5'	6 SD-98-24S/0-0.83	6 STATE1-05	6 STATE2-07	6 STATE2-09	6 STATE2-13	6 STATE2-14	6 STATE2-19
Location											
Depth	feet	2-4.5	0-2	2-5	0-0.83	0-3	0-3	3-4.3	0-3	3-5.1	0-3
Latitude		41.6249	41.6245	41.6245	41.6245	41.62546	41.62546	41.62546	41.62546	41.62546	41.6254
Longitude		-87.5187	-87.51785	-87.51785	-87.5179	-87.5201	-87.5201	-87.5201	-87.5201	-87.5201	-87.5201
Conventionals											
Acid volatile sulfides	µmol/g										
Acid volatile sulfides	mg/kg										
Ammonia-nitrogen	mg/kg					674	622	1060	975	714	566
% clay sized particles	%										
% gravel sized particles	%				0						
% sand + gravel sized prtcls	%										
% sand sized particles	%				53.1						
% silt + clay sized particles	%				46.9						
% silt sized particles	%										
Metals											
Aluminum	mg/kg					12000	7100	11000	13000	9200	8400
Antimony	mg/kg					29	41	10	18	7	69
Arsenic	mg/kg	2.9	13.3	2.9	5.9	44	26	15	32	<8.5	96
Barium	mg/kg					420	310	220	280	91	700
Beryllium	mg/kg					1	0.6	0.7	0.9	0.6	1.2
Boron	mg/kg					6.4	15	37	<9	<8.5	<11
Cadmium	mg/kg	<0.5	1.6	<0.5	3.2	18	22	5.2	6	<1.1	75
Calcium	mg/kg					42000	42000	30000	32000	29000	24000
Chromium	mg/kg	5.3	16.8	5	52.5	280	140	130	140	17	340
Cobalt	mg/kg					9.3	7.4	9.5	8.9	10	14
Copper	mg/kg	16.3	81.5	13.7	159	350	280	260	240	23	670
Cyanide	mg/kg	<0.5									
Iron	mg/kg					54000	39000	30000	32000	28000	160000
Lead	mg/kg	21	196	15.5	185	940	1100	340	460	20	3400
Lithium	mg/kg					15	8.2	17	19	19	7.4
Magnesium	mg/kg					9900	8800	12000	10000	16000	7300
Manganese	mg/kg					460	300	250	330	840	980
Mercury	mg/kg	0.16	3.5	0.078	0.81						
Molybdenum	mg/kg					7.4	4.5	3.3	4.4	<1.6	22
Nickel	mg/kg	7.7	8.3	7.6	13	53	36	31	31	23	160
Potassium	mg/kg					1300	<700	1400	1400	1100	740
Selenium	mg/kg										
Silver	mg/kg					8.5	3.9	1	2.6	<0.6	15
Sodium	mg/kg					490	3000	11000	5800	5300	3800
Strontium	mg/kg					85	70	65	75	38	83
Thallium	mg/kg										

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	6 SD-98-23/2-4.5'	6 SD-98-24/0-2'	6 SD-98-24/2-5'	6 SD-98-24S/0-0.83	6 STATE1-05	6 STATE2-07	6 STATE2-09	6 STATE2-13	6 STATE2-14	6 STATE2-19
Tin	mg/kg					79	110	37	35	<4.3	180
Titanium	mg/kg					180	160	200	210	180	220
Vanadium	mg/kg					26	19	23	24	17	35
Zinc	mg/kg	72.1	517	54.6	562	2900	2300	1700	1700	98	7900
Volatile Organic Compounds											
1,2,4-Trichlorobenzene	µg/kg										
1,2-Dichlorobenzene	µg/kg										
1,3-Dichlorobenzene	µg/kg										
1,4-Dichlorobenzene	µg/kg										
Benzene	µg/kg	14000	<50000	330	270	<190					
Semi-Volatile Organic Compounds											
1,2,3,4-Tetrachlorobenzene	µg/kg										
1,2,3,5-Tetrachlorobenzene	µg/kg										
1,2-Dinitrobenzene	µg/kg										
1,2-Diphenylhydrazine	µg/kg										
1,3-Dinitrobenzene	µg/kg										
1,4-Dinitrobenzene	µg/kg										
2,2'-Oxybis(1-chloropropane)	µg/kg										
2,3,4,6-Tetrachlorophenol	µg/kg										
2,4,5-Trichlorophenol	µg/kg										
2,4,6-Trichlorophenol	µg/kg										
2,4-Dichlorophenol	µg/kg										
2,4-Dimethylphenol	µg/kg										
2,4-Dinitrophenol	µg/kg										
2,4-Dinitrotoluene	µg/kg										
2,6-Dinitrotoluene	µg/kg										
2-Chloronaphthalene	µg/kg										
2-Chlorophenol	µg/kg										
2-Methylnaphthalene	µg/kg	180000	380000	64000	1400	52000	3400000	1500000	1200000	27000	105000
2-Methylphenol	µg/kg										
2-Nitroaniline	µg/kg										
2-Nitrophenol	µg/kg										
2-Picoline	µg/kg										
3,3'-Dichlorobenzidine	µg/kg										
3-Nitroaniline	µg/kg										
4,6-Dinitro-2-methylphenol	µg/kg										
4-Bromophenyl phenyl ether	µg/kg										
4-Chloro-3-methylphenol	µg/kg										
4-Chloroaniline	µg/kg										
4-Chlorophenyl phenyl ether	µg/kg										

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	6 SD-98-23/2-4.5'	6 SD-98-24/0-2'	6 SD-98-24/2-5'	6 SD-98-24S/0-0.83	6 STATE1-05	6 STATE2-07	6 STATE2-09	6 STATE2-13	6 STATE2-14	6 STATE2-19
4-Methylphenol	µg/kg										
4-Nitroaniline	µg/kg										
4-Nitrophenol	µg/kg										
Acenaphthene	µg/kg	190000	310000	55000	1600	130000	1400000	560000	460000	8400	52000
Acenaphthylene	µg/kg	<66000	<66000	<66000	170	<22000	<440000	<106000	<97000	<10200	<61000
Aniline	µg/kg										
Anthracene	µg/kg	67000	100000	18000	790	90000	540000	230000	180000	<10200	50000
Benzidine	µg/kg										
Benzo(a)anthracene	µg/kg	37000	45000	<66000	1600	94000	330000	140000	91000	<10200	79000
Benzo(a)pyrene	µg/kg	36000	35000	<66000	1400	58000	160000	65000	48000	<10200	43000
Benzo(b)fluoranthene	µg/kg										
Benzo(g,h,i)perylene	µg/kg										
Benzo(k)fluoranthene	µg/kg	<66000	<66000	<66000	580	17000	<440000	<106000	<97000	<10200	<61000
Benzoic acid	µg/kg										
Benzyl alcohol	µg/kg										
Bis(2-chloroethoxy)methane	µg/kg										
Bis(2-chloroethyl)ether	µg/kg										
Bis(2-ethylhexyl)phthalate	µg/kg										
Butylbenzylphthalate	µg/kg										
Carbazole	µg/kg										
Chrysene	µg/kg	34000	44000	<66000	2400	99000	320000	150000	93000	<10200	140000
Dibenz(a,h)anthracene	µg/kg	<66000	<66000	<66000	<660	7200	<440000	<106000	<97000	<10200	<61000
Dibenzofuran	µg/kg	7500	13000	<66000	160						
Diethylphthalate	µg/kg										
Dimethylphthalate	µg/kg										
Di-n-butyl phthalate	µg/kg										
Di-n-octylphthalate	µg/kg										
Fluoranthene	µg/kg	88000	110000	19000	2800	130000	520000	210000	150000	<10200	83000
Fluorene	µg/kg	78000	120000	22000	790	83000	590000	290000	190000	<10200	51000
Hexachlorobenzene	µg/kg										
Hexachlorobutadiene	µg/kg										
Hexachlorocyclopentadiene	µg/kg										
Hexachloroethane	µg/kg										
Indeno(1,2,3-c,d)pyrene	µg/kg	<66000	<66000	<66000	<660	23000	<440000	<106000	<97000	<10200	<61000
Isophorone	µg/kg										
Naphthalene	µg/kg	430000	690000	100000	3900	29000	3800000	1600000	1300000	54000	55000
Nitrobenzene	µg/kg										
N-nitrosodimethylamine	µg/kg										
N-nitrosodi-N-propylamine	µg/kg										
N-nitrosodiphenylamine	µg/kg										
Pentachlorophenol	µg/kg										

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	6 SD-98-23/2-4.5'	6 SD-98-24/0-2'	6 SD-98-24/2-5'	6 SD-98-24S/0-0.83	6 STATE1-05	6 STATE2-07	6 STATE2-09	6 STATE2-13	6 STATE2-14	6 STATE2-19
Phenanthrene	µg/kg	230000	340000	63000	2200	320000	1900000	800000	610000	13000	330000
Phenol (µg/kg units)	µg/kg					<22000	<440000	<106000	<97000	<10200	<61000
Phenol (mg/kg units)	mg/kg	<66	<66	<66	<0.66						
Pyrene	µg/kg	120000	160000	28000	3600	220000	830000	330000	240000	5700	200000
Pyridine	µg/kg										
TIC	µg/kg										
Toluene-2,4-diamine	µg/kg										
Total HMW-PAHs (13 PAHs)	µg/kg	348000	427000	179000	12130	608200	2380000	948000	670500	31200	575500
Total HMW-PAHs***	µg/kg	315000	394000	47000	11800	608200	2160000	895000	622000	5700	545000
Total LMW-PAHs (13 PAHs)	µg/kg	1208000	1973000	355000	10850	715000	11850000	5033000	3988500	117700	673500
Total LMW-PAHs***	µg/kg	1175000	1940000	322000	10850	704000	11630000	4980000	3940000	102400	643000
Total PAHs (13 PAHs)	µg/kg	1556000	2400000	534000	22980	1323200	14230000	5981000	4659000	148900	1249000
Total PAHs***	µg/kg	1490000	2334000	369000	22650	1312200	13790000	5875000	4562000	108100	1188000
Unknown	µg/kg										
Polychorinated Biphenyls											
Aroclor 1016	µg/kg										
Aroclor 1221	µg/kg										
Aroclor 1232	µg/kg										
Aroclor 1242	µg/kg										
Aroclor 1248	µg/kg										
Aroclor 1254	µg/kg										
Aroclor 1260	µg/kg										
Total PCBs	µg/kg										
Total PCBs**	µg/kg										
Pesticides											
Aldrin	µg/kg										
Chlordane	µg/kg										
Chlordane - alpha	µg/kg										
Chlordane - gamma	µg/kg										
Chlordane - reported*	µg/kg										
Dieldrin	µg/kg										
Dieldrin only (not Aldrin)	µg/kg										
Endosulfan sulfate	µg/kg										
Endosulfan-alpha	µg/kg										
Endosulfan-beta	µg/kg										
Endrin	µg/kg										
Endrin ketone	µg/kg										
Heptachlor	µg/kg										
Heptachlor + Hept. epox.**	µg/kg										
Heptachlor epoxide	µg/kg										
Hexachlorocyclohexane**	µg/kg										

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	6 SD-98-23/2-4.5'	6 SD-98-24/0-2'	6 SD-98-24/2-5'	6 SD-98-24S/0-0.83	6 STATE1-05	6 STATE2-07	6 STATE2-09	6 STATE2-13	6 STATE2-14	6 STATE2-19
Hexachlorocyclohexane-α	µg/kg										
Hexachlorocyclohexane-β	µg/kg										
Hexachlorocyclohexane-δ	µg/kg										
Lindane	µg/kg										
Methoxychlor	µg/kg										
o,p'-DDD	µg/kg										
o,p'-DDE	µg/kg										
o,p'-DDT	µg/kg										
p,p'-DDD	µg/kg										
p,p'-DDE	µg/kg										
p,p'-DDT	µg/kg										
Sum DDD	µg/kg										
Sum DDD**	µg/kg										
Sum DDE	µg/kg										
Sum DDE**	µg/kg										
Sum DDT	µg/kg										
Sum DDT**	µg/kg										
Total DDT	µg/kg										
Total DDT**	µg/kg										
Total DDT***	µg/kg										
Toxaphene	µg/kg										
Dioxins											
2,3,7,8-Dibenzo-p-dioxin	µg/kg										

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	6 STATE2-20	7 SD-13	7 SD-98-16/0-2'	7 SD-98-16/2-4.5'	7 UG-10	7 UG10 Bottom	7 UG10 Middle	7 UG10 Top
Location									
Depth	feet	0-3	2-4	0-2	2-4.5	Surface	6-9	3-6	0-3
Latitude		41.6255	41.6258	41.6258	41.6258	41.62592	41.62592	41.62592	41.62592
Longitude		-87.5201	-87.5214	-87.5215	-87.5215	-87.52284	-87.52284	-87.52284	-87.52284
Conventionals									
Acid volatile sulfides	µmol/g					158.6			
Acid volatile sulfides	mg/kg					5085.6676			
Ammonia-nitrogen	mg/kg	441							
% clay sized particles	%								0.03
% gravel sized particles	%								
% sand + gravel sized prtcls	%								94.44
% sand sized particles	%								
% silt + clay sized particles	%								
% silt sized particles	%								5.53
Metals									
Aluminum	mg/kg	13000							
Antimony	mg/kg	28							
Arsenic	mg/kg	38	30	6.5	2.4				
Barium	mg/kg	550	190						
Beryllium	mg/kg	1							
Boron	mg/kg	9.2							
Cadmium	mg/kg	20	18	5.6	<0.5	18			
Calcium	mg/kg	50000							
Chromium	mg/kg	200	110	41.5	4.1	97			
Cobalt	mg/kg	10							
Copper	mg/kg	410		122	8.6	257			
Cyanide	mg/kg		4	1	<0.5				
Iron	mg/kg	50000				2310			
Lead	mg/kg	840	3400	627	9.5	1306			
Lithium	mg/kg	20							
Magnesium	mg/kg	13000				7239			
Manganese	mg/kg	560				614			
Mercury	mg/kg		1.3	1.9	0.016				
Molybdenum	mg/kg	7.2							
Nickel	mg/kg	45		23.4	6.4	55			
Potassium	mg/kg	1400							
Selenium	mg/kg		<25						
Silver	mg/kg	7.3	4.3						
Sodium	mg/kg	520							
Strontium	mg/kg	130							
Thallium	mg/kg								

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	6 STATE2-20	7 SD-13	7 SD-98-16/0-2'	7 SD-98-16/2-4.5'	7 UG-10	7 UG10 Bottom	7 UG10 Middle	7 UG10 Top
Tin	mg/kg	66							
Titanium	mg/kg	210							
Vanadium	mg/kg	27							
Zinc	mg/kg	3000		462	38.8	125			
Volatile Organic Compounds									
1,2,4-Trichlorobenzene	µg/kg								
1,2-Dichlorobenzene	µg/kg								
1,3-Dichlorobenzene	µg/kg								
1,4-Dichlorobenzene	µg/kg								
Benzene	µg/kg		9300	1000	2700				
Semi-Volatile Organic Compounds									
1,2,3,4-Tetrachlorobenzene	µg/kg								
1,2,3,5-Tetrachlorobenzene	µg/kg								
1,2-Dinitrobenzene	µg/kg								
1,2-Diphenylhydrazine	µg/kg								
1,3-Dinitrobenzene	µg/kg								
1,4-Dinitrobenzene	µg/kg								
2,2'-Oxybis(1-chloropropane)	µg/kg								
2,3,4,6-Tetrachlorophenol	µg/kg								
2,4,5-Trichlorophenol	µg/kg								
2,4,6-Trichlorophenol	µg/kg								
2,4-Dichlorophenol	µg/kg								
2,4-Dimethylphenol	µg/kg								
2,4-Dinitrophenol	µg/kg								
2,4-Dinitrotoluene	µg/kg								
2,6-Dinitrotoluene	µg/kg								
2-Chloronaphthalene	µg/kg								
2-Chlorophenol	µg/kg								
2-Methylnaphthalene	µg/kg	48000	<165000	10000	36				
2-Methylphenol	µg/kg								
2-Nitroaniline	µg/kg								
2-Nitrophenol	µg/kg								
2-Picoline	µg/kg								
3,3'-Dichlorobenzidine	µg/kg								
3-Nitroaniline	µg/kg								
4,6-Dinitro-2-methylphenol	µg/kg								
4-Bromophenyl phenyl ether	µg/kg								
4-Chloro-3-methylphenol	µg/kg								
4-Chloroaniline	µg/kg								
4-Chlorophenyl phenyl ether	µg/kg								

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	6 STATE2-20	7 SD-13	7 SD-98-16/0-2'	7 SD-98-16/2-4.5'	7 UG-10	7 UG10 Bottom	7 UG10 Middle	7 UG10 Top
4-Methylphenol	µg/kg								
4-Nitroaniline	µg/kg								
4-Nitrophenol	µg/kg								
Acenaphthene	µg/kg	170000	<165000	5300	<660				
Acenaphthylene	µg/kg	<54000	<165000	<3300	<660				
Aniline	µg/kg								
Anthracene	µg/kg	99000	<165000	5400	140				
Benzidine	µg/kg								
Benzo(a)anthracene	µg/kg	68000	<165000	5400	<660	170	22500	ND	ND
Benzo(a)pyrene	µg/kg	36000	<165000	3600	<660	32510	2800	197200	109500
Benzo(b)fluoranthene	µg/kg								
Benzo(g,h,i)perylene	µg/kg								
Benzo(k)fluoranthene	µg/kg	12000	<165000	1400	<660	3100	4500	ND	ND
Benzoic acid	µg/kg								
Benzyl alcohol	µg/kg								
Bis(2-chloroethoxy)methane	µg/kg								
Bis(2-chloroethyl)ether	µg/kg								
Bis(2-ethylhexyl)phthalate	µg/kg								
Butylbenzylphthalate	µg/kg								
Carbazole	µg/kg								
Chrysene	µg/kg	77000	<165000	6700	<660	2570	9400	ND	ND
Dibenz(a,h)anthracene	µg/kg	<54000		<3300	<660				
Dibenzofuran	µg/kg			2700	<660				
Diethylphthalate	µg/kg								
Dimethylphthalate	µg/kg								
Di-n-butyl phthalate	µg/kg								
Di-n-octylphthalate	µg/kg								
Fluoranthene	µg/kg	110000	<165000	5900	110	6830	17400	28260	15270
Fluorene	µg/kg	91000	<165000	4900	<660				
Hexachlorobenzene	µg/kg								
Hexachlorobutadiene	µg/kg								
Hexachlorocyclopentadiene	µg/kg								
Hexachloroethane	µg/kg								
Indeno(1,2,3-c,d)pyrene	µg/kg	12000		<3300	<660				
Isophorone	µg/kg								
Naphthalene	µg/kg	24000	<165000	8400	76	8240	8460	9680	4610
Nitrobenzene	µg/kg								
N-nitrosodimethylamine	µg/kg								
N-nitrosodi-N-propylamine	µg/kg								
N-nitrosodiphenylamine	µg/kg								
Pentachlorophenol	µg/kg								

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

		6	7	7	7	7	7	7	7
Substance	**Units**	**STATE2-20**	**SD-13**	**SD-98-16/0-2'**	**SD-98-16/2-4.5'**	**UG-10**	**UG10 Bottom**	**UG10 Middle**	**UG10 Top**
Phenanthrene	µg/kg	320000	<165000	26000	130	2550	186800	9380	9870
Phenol (µg/kg units)	µg/kg	<54000				5100	20	470	6180
Phenol (mg/kg units)	mg/kg			<3.3	<0.66				
Pyrene	µg/kg	190000	<165000	13000	110	4200	19000	12110	6280
Pyridine	µg/kg								
TIC	µg/kg								
Toluene-2,4-diamine	µg/kg								
Total HMW-PAHs (13 PAHs)	µg/kg	508000	<825000	36250	1540	46280	71100	237570	131050
Total HMW-PAHs***	µg/kg	481000		34600	1210	46280	71100	237570	131050
Total LMW-PAHs (13 PAHs)	µg/kg	779000	<1155000	61650	1372	10790	195260	19060	14480
Total LMW-PAHs***	µg/kg	752000		60000	382	10790	195260	19060	14480
Total PAHs (13 PAHs)	µg/kg	1287000	<1980000	97900	2912	57070	266360	256630	145530
Total PAHs***	µg/kg	1233000		94600	1592	57070	266360	256630	145530
Unknown	µg/kg								
Polychorinated Biphenyls									
Aroclor 1016	µg/kg		<80000						
Aroclor 1221	µg/kg		<80000						
Aroclor 1232	µg/kg		<80000						
Aroclor 1242	µg/kg		<80000						
Aroclor 1248	µg/kg		<80000			7930	18660	9040	13650
Aroclor 1254	µg/kg		<80000						
Aroclor 1260	µg/kg		<80000						
Total PCBs	µg/kg		<560000			7930	18660	9040	13650
Total PCBs**	µg/kg					7930			
Pesticides									
Aldrin	µg/kg								
Chlordane	µg/kg					2140	8110	5760	1370
Chlordane - alpha	µg/kg								
Chlordane - gamma	µg/kg								
Chlordane - reported*	µg/kg					2140			
Dieldrin	µg/kg					1140	7410	6920	2830
Dieldrin only (not Aldrin)	µg/kg					1140			
Endosulfan sulfate	µg/kg								
Endosulfan-alpha	µg/kg								
Endosulfan-beta	µg/kg								
Endrin	µg/kg								
Endrin ketone	µg/kg								
Heptachlor	µg/kg					190	7270	1220	160
Heptachlor + Hept. epox.**	µg/kg					190			
Heptachlor epoxide	µg/kg								
Hexachlorocyclohexane**	µg/kg					260			

Table D-1. Historical Sediment Chemistry Data for West Branch of Grand Calumet River (by Reach and Station)

Substance	Units	6 STATE2-20	7 SD-13	7 SD-98-16/0-2'	7 SD-98-16/2-4.5'	7 UG-10	7 UG10 Bottom	7 UG10 Middle	7 UG10 Top
Hexachlorocyclohexane-α	µg/kg								
Hexachlorocyclohexane-β	µg/kg								
Hexachlorocyclohexane-δ	µg/kg								
Lindane	µg/kg					260	380	60	50
Methoxychlor	µg/kg								
o,p'-DDD	µg/kg								
o,p'-DDE	µg/kg								
o,p'-DDT	µg/kg								
p,p'-DDD	µg/kg					<10	ND	560	ND
p,p'-DDE	µg/kg					2710	5220	14690	6800
p,p'-DDT	µg/kg					90	1450	3380	2610
Sum DDD	µg/kg								
Sum DDD**	µg/kg								
Sum DDE	µg/kg								
Sum DDE**	µg/kg					2710			
Sum DDT	µg/kg								
Sum DDT**	µg/kg					90			
Total DDT	µg/kg					2805	6670	18630	9410
Total DDT**	µg/kg					2800			
Total DDT***	µg/kg					2805	6670	18630	9410
Toxaphene	µg/kg					2050	2850	15460	1140
Dioxins									
2,3,7,8-Dibenzo-p-dioxin	µg/kg					0.0000073			

* Using the Human Health exclusion

** Using the Human Health calculations

*** Excluding values with DL>PEC

Source of data: *An Assessment of Sediment Injury in the Grand Calumet River, Indiana Harbor Canal, Indiana Harbor, and the Nearshore Areas of Lake Michigan* (MacDonald and Ingersoll, 2000)